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ZONES.
Arctic.
Boreal.
Transition.
Upper Austral.
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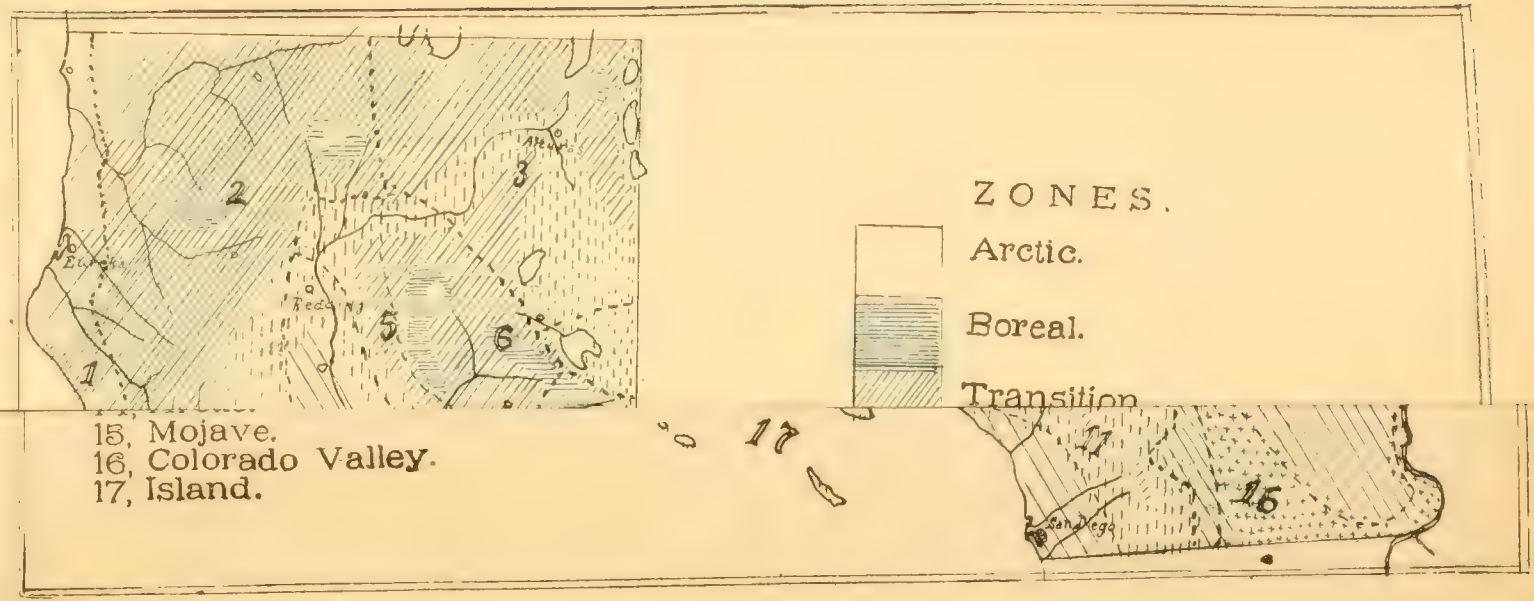

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LIFE AREAS OF CALIFORNIA

BY

FRANK STEPHENS

Most people who have ascended mountains, on business or for pleasure, have noticed that there was a gradual change in the trees and other vegetation as height was gained, and some see that there is a system in this change. At a certain height in one mountain occurs a combination of trees, shrubs, plants, birds, insects and mammals, which combination is repeated in a general way on other mountains at a similar altitude, modified by local causes, such as soil, angle or direction of slope, nearness or remoteness of large bodies of water, height above base level and other conditions. Going higher, a change in the birds, trees, etc., occurs through the gradual disappearance of some species and the substitution of others until a new combination is formed. A similar combination is repeated in other mountains of the region in about the same order. Local causes modify these repetitions more or less, but the general similarity is sufficient to force the close observer to the conclusion that they are controlled by general natural laws. Within a few years much study has been given to the elucidation of these natural laws, and I will attempt to summarize some of the results of these investigations in California.

The causes controlling the geographical distribution of life are many, the most important being temperature, moisture, soil and light. We are accustomed to sum up three of these leading causes in the word climate.

The most important single cause of the varied distribution of life is heat: its quantity and daily and yearly range over a given area. Other conditions being equal, the warmer the climate of a locality is, the more luxuriant and varied its forms of life will be. A great

yearly or daily range of temperature unfavorably affects the life of an area by weeding out the forms most sensitive to such changes, on the principle of the "survival of the fittest".

The heat of a locality is affected by its latitude, altitude, direction of the prevailing winds, height above base level and slope exposure. Increase of latitude and altitude produce similar climatic effects, the higher area having a similar climate to that of the lower area situated a certain distance further from the equator. In other words, a traveler passing from the tropics toward the poles at sea level finds the climate steadily becoming colder; in climbing a mountain the same change is observed.

If the area of high altitude is great it is warmer than a small similar area at the same height and latitude, for the reason that the greater area conserves the greater amount of heat as daily received from the sun. It sometimes happens that the base level on one side of a mountain range is higher than that on the other side; in this case the higher level tends to raise the temperature and therefore the life zones on that side. A good illustration is the Himalaya Mountain range. The plain on the south side is several thousand feet higher than the plateau on the north side; in consequence of this difference of base level on the two sides the timber line and snow line are about three thousand feet higher on the north than on the south side. This is in direct opposition to the effect of latitude which would tend to lower the snow line on the north side. The Sierra Nevada Mountains are another illustration. The plateau on the eastern side is from three to four thousand feet higher than the San Joaquin and Sacramento valleys on the west side, and in consequence all the life zones are higher on the east side than on the west.

Slope exposure is another disturbing cause. A slope directly facing the sun is warmer than one facing away from it. This is very noticeable in many canyons running east and west in semi-arid parts of California, in which case the timber will be found growing considerably lower down on the side receiving the least amount of direct sunshine.

Prevailing winds coming directly from large bodies of water tend to cool the region contiguous and therefore lower the life zones.

The next most important agent in the distribution of life is moisture. The greater or lesser amount of moisture present in air and

soil strongly affects the vegetable growth of a locality; as animal life of a locality is practically dependent on the vegetation it is in that way affected by the proportion of moisture present. The amount of moisture of a region is regulated by its distance from large bodies of water, the direction of the prevailing air currents, and the height of intervening obstacles, such as mountain ranges. Most of the moisture present in the air originates in the evaporation of seas and other large bodies of water. The moisture laden air moving inland when cooled is unable to hold up all its moisture, which falls as rain. A high range of mountains will greatly cool the air currents passing over it and the heavy rainfall or snowfall resulting may abstract so much of the moisture from the air, that little is left for the region beyond the mountains, which thus becomes arid. The region of the Colorado and Mojave Deserts and the greater part of Nevada is an illustration of the drying influence which the Sierra Nevada Mountains exert on the air currents passing over them.

The quality of the soil is another factor in the quantity and character of the plant and animal life of a region. The carnivorous species of animals of a region subsist on the herbivorous species; these subsist on the leaves, stems, seeds or root of plants which draw their nourishment from the soil; therefore a richer or poorer soil has a considerable direct influence on such apparently remotely connected beings as the foxes or hawks that live in a region.

Dr. C. Hart Merriman has formulated certain laws of the distribution of life which appear to be based on sound reasoning from a sufficient mass of observed facts to assure their correctness.

"The northward distribution of animals and plants is determined by the total amount of heat—the sum of effective temperatures.

The southward distribution of Boreal, Transition zone, and Upper Austral species is determined by the mean temperature of the hottest part of the year."

If the North Temperate Realm was composed of sea and level land only, its life zones would nearly follow parallels of latitude around the northern hemisphere, deflected here and there by the effects of warm or cold ocean currents on the shores they wash. The presence of mountain ranges breaks up such uniformity of climate and renders the definition of life zones very difficult, nowhere more so than in California, where, in many mountains, island-like areas are detached from the main bodies of their zones or long

points project, or narrow bands curve to follow the sinuosities of the mountain sides. The peculiar topography of this state produces a variety of life zones which is probably equaled by no other similar area elsewhere. Bordered as California by the sea; traversed its whole length by a mountain range, in places carrying perpetual snow; possessing considerable areas lying below sea level; having a range of annual rainfall varying from 80 inches in the northwestern part of the State to 3 or 4 in the southeastern part, it offers the student of climatology and of the distribution of life facilities unsurpassed in any civilized country, and problems unknown in most other parts of the world.

Long ago geographers divided the earth's surface into five zones, giving them definite boundaries of certain parallels of latitude founded on astronomical considerations. Biologists have also divided the earth's surface into life zones and other divisions. These divisions seldom have very definite boundaries, but blend into one another.

For my present purpose I shall follow the division of the northern hemisphere into three Life Realms, as follows: The Arctic Life Realm, surrounding the north pole and passing southward to the northern limit of trees, or about the annual isotherm of 32 degrees; the North Temperate Life Realm, extending southward from the Arctic Life Realm to about the annual isotherm of 70 degrees; and a Tropical Life Realm. These Life Realms are subdivided into Life Zones as follows: An Arctic Life Zone, consisting of all the Arctic Life Realm; a Boreal Life Zone consisting of the upper or northern part of the North Temperate Life Realm south to about the summer isotherm of 63 degrees; a Transition Life Zone, consisting of that part of the same Realm bounded above or on the north by the summer isotherm of 63 degrees, and below or south by the summer isotherm of 70 degrees; an Upper Austral Life Zone lying between the summer isotherms of 70 degrees and 77 degrees; a Lower Austral Life Zone consisting of the remainder of the North Temperate Life Realm; and a Sub-Tropical Life Zone consisting of the northern part of the Tropical Life Realm. This covers but a small area in southeastern California. That part of the Arctic Life Zone in California is still smaller, consisting of a few small isolated areas on the highest mountain summits.

The distribution of life being affected also by the greater or less average amount of moisture present in a given area, and as this

average amount of moisture varies in portions of each life zone it follows that the distribution of life is not equal throughout a life zone. To give expression to the effects of the varying amounts of moisture in life realms and life zones they are divided in sections of variable size called regions, sub-regions and provinces. That part of the North Temperate Life Realm on this continent is known as the North American Region. That part of this region in western North America having a small annual rainfall is known as the Arid Sub-Region, and the part near the sea having a large rainfall is the Pacific Coast Sub-Region. The Arid Sub-Region has been divided into two provinces: the Sonoran Province consisting of that part in the Lower Austral and Sub-Tropical Zones; and the Campestrian, consisting of that part in the Upper Austral and Transition Zones.

I propose further subdividing the life areas of California into Faunas, to consist of areas of nearly equal temperature, moisture and soil, and the therefore a nearly homogeneous local assemblage of life forms. These will not be equal in either size or value, and are intended only to facilitate the study of distribution of species in California. The boundaries of Life Zones and Faunas as indicated on the accompanying map are only provisional; further study will necessitate numerous changes.

The Californian Arctic Fauna is that part of the Arctic Life Zone in California. A few species of plants constitute the only peculiarly Arctic life in California, as the areas are so small that animal life of strictly Arctic species has disappeared, with the possible exception of insects.

The Boreal Zone is forested nearly throughout its extent in California. The principal forest trees are the Foxtail Pine, White-barked Pine, Mountain Pine, Tamarack Pine, and Red Fir. The Californian mammals peculiar to this zone are the Gray-headed Pika, Mountain Beaver, Yellow-bellied Marmot, Belding Ground Squirrel, Alpine, Sierra Nevada and Alpine Chipmunks, Californian Pine Squirrel, Black Fox, Wolverine, Pine Marten and Ermine. Some of the birds breeding principally or exclusively in this zone are Sooty Grouse, White-headed Woodpecker, Williamson Woodpecker, Western Nighthawk, Calliope Hummingbird, Olive-sided Flycatcher Gray-eared Finch, White-crowned Sparrow, Lincoln Sparrow, Thick-billed Sparrow, Green-tailed Towhee, Audubon Warbler and Black-throated Gray

Warbler. The Californian part of the Boreal Zone may be called the Californian Alpine Fauna.

The Transition Zone is of considerable extent in northern California, but is of less extent in the southern part of the state, where it is limited to the sides and upper parts of the mountains, except that small part rising above about 7,000 feet altitude, which is Boreal. In most parts of the state the Transition Zone is well timbered, and is the great source of supply of wood and lumber in this state. The Yellow, Black and Sugar Pines, White Fir, Cedar and Redwood are characteristic of this zone. It contains a large number of species of birds and mammals, though few, perhaps none, are limited to it, nearly all its species being found in the adjoining zones, either above or below. Some of the birds breeding principally in it are the Californian Woodpecker, Blue-fronted Jay, Californian Purple Finch, Violet-green Swallow and Mountain Chickadee.

The Transition zone in California may be divided into several Faunas. The northeast part of the state, north of Honey Lake and east of Mt. Shasta, may be called the Modoc Fauna. It is a high broken plateau with some coniferous timber on the highest parts. A character of this Fauna is the abundant presence of sage brush *(Artemesia)*. South of the Modoc Fauna is a large area of the Transition Zone in the lower parts of the Sierra Nevada Mountains which may be called the Sierra Nevada Fauna. It is mostly well timbered, with Yellow Pine as the principal species. Those areas of the Transition Zone lying south of Lat. 35 degrees may appropriately take the name of the San Bernardino Fauna. Here also the Yellow Pine is a characteristic tree. The region about Mt. Shasta, north to Oregon and west to the low strip along the sea coast may provisionally take the name of the Shasta Fauna until its features are better known. I know nothing of this fauna personally and I can find very little published concerning its faunal conditions. A narrow strip along the seacoast from the Oregon line south to San Francisco may be called the Humboldt Fauna. This is a region of heavy rainfall and fogs, and a strong character is the presence of heavy redwood forests. A continuance of this narrow strip along the coast southward, including the Santa Cruz Mountains, and ending a short distance south of Point Sur, may take the name of the Santa Cruz Fauna. It presents similar characters to that of the Humboldt Fauna, but in a less marked degree.

The Upper Austral Zone lies next below or south of the Transition Zone. In many parts of the Upper Austral Zone a thick growth of several species of shrubs, collectively known as chapparral or chemisal, covers the hills. Forests are few and west of the Sierras are composed mostly of oaks, which east of the Sierras are replaced by Pinons and Junipers. The Gray-leafed Pine is common in this Zone in some places within the drainage of the San Joaquin and Sacramento valleys. The most characteristic mammals of the Upper Austral Zone are Pocket rats, two genera and several species, Pocket Mice of several species, Californian Grasshopper Mice, Striped Skunk, Gray and Island Foxes. The following species of birds find their upper or northern limits in this zone, Nuttall Woodpecker, Costa Hummingbird, Yellow-billed Magpie, Nelson Oriole, Lawrence Goldfinch, Black-throated Sparrow, Long-tailed Chat, Californian Thrasher and Black-tailed Gnatcatcher.

That part of the Upper Austral Zone lying on the west side of the Sierra Nevada Mountains, consisting of a long narrow strip along the sides of the lower parts of the mountains, may be called the Foothill Fauna. A broken region of moderate extent, bounded on the west by the Humboldt Fauna, on the north by the Shasta Fauna, on the east and south by the Sacramento Valley, may be called the Clear Lake Fauna. The region bounded on the west and southwest by the Santa Cruz Fauna and the Pacific Ocean, on the southeast by the Santa Ynez Mountains and on the northeast by the San Joaquin Valley may be called the San Luis Obispo Fauna. All the islands lying off the Southern California coast may be grouped together under the name of the Island Fauna. That part of the Upper Austral Zone south of the San Luis Obispo Fauna, and the Mojave Desert and west of the Colorado Desert may be called the San Jacinto Fauna.

The Lower Austral Zone includes most of the Mojave Desert, the San Joaquin and Sacramento valleys, and a strip along the coast from Santa Barbara to San Diego and southward. Over much of this area cactuses form a characteristic part of the vegetation. But few trees occur and these are found mostly along streams and in damp land. Much of this zone is very arid. Shrews are nearly wanting in this zone. Several species of bats find their northern limit in it, as do several species of ground squirrels. No species of tree squirrels or chipmunks (genera *Sciurus* and *Eutamias*) occur. Several species

of pocket rats and pocket mice and the Big-eared Fox are peculiar to this zone, the Gambel Partridge, Scott Oriole, Leconte Thrasher, Crissal Thrasher, Yellow-headed Tit and Plumbeous Gnatcatcher.

The large valley known as the Sacramento Valley (northern part), and San Joaquin Valley (southern part) may be called the Sacramento Fauna. The comparatively small area of Lower Austral Zone in the southwestern part of the state may be called the San Diego Fauna. In the eastern part of the state is a large area of arid plain, studded with small barren mountains, known as the Mojave Desert. It is principally Lower Austral Zone, but has a few tracts sufficiently elevated to reach the Upper Austral and a few very small areas of Transition Zone. This area north of the low Colorado Desert and west of the bottom lands of the Colorado River may be called the Mojave Fauna.

The Sub-Tropical Zone in California is confined to the bottom land along the Colorado River and west in the Colorado Desert, which is properly a part of the same bottom lands. Among the birds which do not breed above this zone and are found in this part of California are the Harris Hawk, probably the Audubon Caracara, Elf Owl, Vermillion Flycatcher, Abert Towhee and Cooper Tanager. This part of the Sub-Tropical Zone may be called the Colorado Valley Fauna.

AN ADDRESS

Before the San Diego Academy of Natural Sciences, on the Books Relating to Geology, Mineral Resources and Palæontology of California.

BY

ANTHONY W. VOGDES

In the early days the Science of Geology formed a part of Mineralogy, and subsequently, Physical Geology. The earliest writer to dignify the science was Dr. Saussure, in the year 1778. This great explorer of the Alps was the first to adopt a name for the science of Geology, instead of the old name of Cosmology.

The earliest account of the Geology of California, was that given by the Rev. William Buckland, in Beechey's Narration of a Voyage to the Pacific and Behring's Strait, in 1831. Dr. Buckland was born in Devonshire in 1784, and for many years held the chair of Geology at the University of Oxford. He was the founder of the museum of Geology of that University, and one of the founders of the Science of Geology. In the Volume on the Zoology, Dr. Buckland gives several references to the geology of the vicinity of San Francnsco Bay, prepared from notes and collections of Lieut. Belcher, with a map of the headlands embracing San Francisco Bay. This early map indicates the several formations. Serpentine, sandstone, and jasper rocks are represented.

In the Geology of the Bay of San Francisco he gives an account of the Geology of San Francisco,—with notes of the earthquakes in 1806, also that of 1827.

In the report of the Exploring Expedition to the Rocky Mountains in 1842, Captain Fremont gives a few geological notes on California.

There are also notes regarding the geology of California in Emory's Reconnaissance from Fort Leavenworth, to San Diego, Califor-

nia, and in the report of Col. Cook's march from Santa Fe to San Diego, published in 1848.

In the U. S. Exploring Expedition, Vol. X, Geology, Prof. James D. Dana gives an account of the Geology of Shasta Mountains, also that of San Francisco Bay, with a description of the fossils of Astoria, Oregon, many of which are common to the Palaeontology of California.

Only 200 copies of this volume with its Atlas were published and it is one of the rarest works of California Geology.

During the year 1848-49, other expeditions and journals gave a few topographical and Geological notes; such as Capt. Johnson's expedition from Santa Fe to San Diego,—and Col Cooke's march of the Mormon Battalion.

With the discovery of gold in 1848, numerous notices appeared. The most important Reports were those by Dr. Tyson: Information in Relation to the Geology of California, Washington, 1850. This work contains articles on the Geology of the Sierra Nevada Mountains, also that of the Coast Range, with the geological structure of the Sacramento Valley; Gold regions of the Sierra Nevada,—the quicksilver mines, etc.

This work was republished with an introduction and an index, at Baltimore, in 1851.

The most important official document published at this date was the report of the Secretary of War, Part 2.

It contains a topographical memoir, with map of the Sacramento Valley, by Lieut. G. H. Derby, pp. 2-16, with Warner's reconnoissance of a route through the Sierra Nevada by the upper Sacramento, pp. 16-34.

Exploration of Monte Diablo, etc., by Lieut. Williamson.

The reports of the Secretary of War, 1850, contain an account of boring near Benicia, by Major Vinton, pp. 278-279.

T. Butler King's report on California, 1850, gives an account of the Geology of the Gold Regions.

House Doc. No. 17, 31st Congress, 1850, contains a letter from Col. Mason. This letter is the first official report on the discovery of gold in California. He gives a description of the country along the American river, and an historical account of the mining regions, also a description of the San Jose quicksilver mines. In the same docu-

ment there is an account of a tour made to the gold regions by Gen. Riley, pp. 785-792.

In 1857, Dr. James Hall, in the U. S. and Mexican Boundary Survey, gave a short description of the geology of Southern California, with a section of lignite bluff near San Diego.

Captain Aubrey, gives some notes of the route through the gold country on the head waters of the San Juan, Salinas, etc., in notes on route from near Tejon Pass, through Western New Mexico, and the Colorado to Santa Fe, in the fall of 1853.

In the publication of the Navy Department, House of Rep., Doc. 206, 42nd Congress, 1872, there is a report on the Mount Diablo coal mines of California, by B. F. Isherwood.

In the reports of Explorations and Survey for a railroad from the Mississippi to the Pacific, Volumes 3, 5, 6 and 7, contain geological information of California. Vol. 3, contains Jules Marcou's reports of routes explored near the parallel of 35 deg. North Latitude, with notes of geology of Los Angeles.

Vol. V, contains general observations upon the geology of the route, 35 and 32 parallels—Geological reports by Wm. P. Blake.

Chapter 1—San Francisco to San Joaquin River—Chapters 2 and 3, Fort Miller to Ocoya Creek, etc.; also chapters on the vicinity of Tejon, Mojave River, Los Angeles, San Bernardino, Colorado Desert, Warner's, Fort Yuma, San Francisco Bay, etc.

Prof. Louis Agassiz, describes and figures the fossil fish of Ocoya Creek, and Conrad, the fossil shells, including those from San Diego, and Monterey County, Colorado Desert, etc.

Vol. 6, contains reports by John S. Newberry, on the geology of San Francisco, Sacramento Valley, Western range of Sierra Nevada, also that of Pitt River and Klamath Basin. The Tertiary fossils collected were described by T. A. Conrad, from Santa Clara, Monterey County, Santa Barbara, etc.

Vol. 7, contains geological reports by Thomas Antisell—Geology of the Coast Range, also geology of the district from San Diego to Fort Yuma, etc.

Reports on Palaeontology, by T. A. Conrad—The fossil shells collected in California, by Wm. P. Blake, were also published in a pamphlet in 1855; also in final report in Vol. 1 of the Pacific R. R. Survey.

In the reports of the Mineral resources of the States and Terri-

tories west of the Mississippi, by J. Ross Brown and James W Taylor.

There are many notes on geological formation of the Pacific Coast, with resources in Gold, Copper, Quicksilver, etc. In that for 1867, there is an annotated catalogue of the minerals by Wm. P. Blake.

The report for 1868, contains a geographical and physical sketch of Lower California, by W. M. Gabb.

The reports for 1869-1875, by R. W. Raymond, contains many articles on minerals with a Geological map of the U. S., with several articles by A. W. Bowman, on Plieocene rivers, Geology of Plumas County, by J. A. Edman.

Petroleum in California, by F. A. Clark, etc.

The report of U. S. Mint for 1880-1900, contains statistics of the production of the precious metals.

The report of U. S. Coast survey for 1855, contains Observations on Geology of the Coast of California, from Bodega Bay to San Diego, by W. P. Blake.

The 10th U. S. Census, Vol. VI, Part 2, contains a general description of the geology of California, with reports on building stones of U. S., by Geo. P. Merrill, in Vol. X, 1884.

Notes on Iron Ore collected west of the 100 Meridian, by Bayard T. Putman, Vol. XV, 1886.

In the 11th U. S. Census Report, there are special reports on Gold, Silver, Quicksilver, Coal, Petroleum, etc.

In Lieut. George W. Wheeler's survey west of the 100 Meridian, Jules Marcou, has a special report on the geology of a portion of Southern California—Rep. of Chief of Engs., 1876, Appendix H.

The geological and mineralogical character of Southern California and adjacent regions are reported on by Oscar Loew—Appendix H^2, pp. 393-419, Geology of the mountain ranges from La Veta pass to head of Pecos, by A. R. Conklin.

In the preliminary report of Explorations in Nevada and Arizona in 1872, there are a few notes on the mining districts of California.

The report of 1877 contains a geological report on a portion of Eastern California, area examined, bounded on the north by Truckee and Washoe City, on the east by Mount Davidson range, and Como Mountains, and on the south by Job's Peak and Pyramid Peak, on the west by Truckee River.

In Hayden's Geological Survey, the 12th Report is the only one containing notes of California. Dr. White, described a *Productus giganteus* Martin, from McCloud's River.

In the contributions of the fossil Flora of the Western Territories, Leo Lesquereux describes several California fossil plants.

The Monographs, Statistical Papers, Annual Reports, and Bulletins of the U. S. Geological Survey, contain many papers on the Geology and Palaeontology and mineral resources of California.

The most important are those of J. S. Diller, on the Geology of Lassen Peak. The Quicksilver Deposits of the Pacific Slope, by George F. Becker.

Dr. White's papers on the Palaeontology of California in the Bulletins. The Earthquakes, by James E. Keeler, E. S. Holden, and Charles D. Perrine.

Contributions to the Cretaceous Palaeontology of the Pacific Slope, by F. W. Stanton. This bulletin describes the Knoxville beds; geographic distribution, local development in Tehama, Colusa, Lake, and Napa Counties, Mount Diablo, and other loccalities, etc.

There is also a paper by the same author on the Faunal Relations of the Eocene and Upper Cretaceous, in the 17th Annual Report.

The Mineral Resources, by David P. Day, to all the reports.

Reports on Geological maps of the U. S., by Jules Marcou and John B. Marcou.

Chemistry and Physics, by F. W. Clark.

The publications of the Smithsonian Institution, contains only two reports on the Geology. The first by Hitchcock, Illustrations of Surface Geology, 1857, pp. 107-108, on the erosions of the west side of the Sierra Nevada Mountains, and the second, by Geo. P. Merrill, on building and ornamental stones. Report for 1886.

The publications of the U. S. National Museum contain papers by W. H. Dall, of the fossils of the Coast Range, with a paper by Geo. P. Merrill, on onyx marbles, also notes on the Geology and Natural History of Lower California, etc.

The Geological Survey of the State of California was organized in 1853, by a resolution of the Senate, calling upon Mr. John B. Trask, for such information as he may possess, relating to the Geology of the State. Dr. Trask's report on the Geology of the Sierra Nevada or California range is a small pamphlet of 31 pp.—Sacramento, 1853.

The author gives a concise sketch of the geology and resources, from his reconnoissances of 1850-52, embraced within the 36th and 42nd degs. of North Latitude.

The second report was on the Geology of the Coast Mountains, Sen. Doc. No. 14, Sacramento, 1855. 95 pp. It contains description of the physical geography of the Coast Mountains and other geological information; Geology of San Bernardino Mountains, Stratified Rocks of San Bernardino chain, and plains of Los Angeles County, north of American River; mineral districts of the upper Sacramento Valley, Geology of northern Coast Mountains, etc.

The third report, by Dr. John B. Trask, on the Geology of the Coast Mountains and part of the Sierra Nevada—Assembly Doc. No. 9,1854. 92 pp., contains a description of the geology of Monte Diablo, Salinas Valley, Santa Cruz Mountains, Sacramento and San Joaquin Valleys, Position of the volcanic rocks to the Tertiaries, etc.

The final report on the Geology of Northern and Southern California, Assembly Doc. No. 14, 1856, contains 66 pp.

It contains a description of the physical geography of the Coast Mountains north of San Francisco Bay, etc.; Geology of Table Mountains, Tuolumne Co., California; rock of northern district, Shasta County, etc., etc.

In the Surveyor General's reports there are papers on Geology of part of Calaveras County—Doc. No. 5, Appendix F, 1855, with a report of a survey of a portion of the section boundary of California, and a reconnoissance of the old Carson and Johnson immigrant roads, in the Report of 1856.

The second Geological Survey of California, J. D. Whitney, State Geologist, consists of several addresses to the Legislature of California, with lectures on Geology. The final reports included the Yosemite Guide Books, in several additions; Catalogues of the Invertebrate fossils.

Palaeontology, in two Volumes ;

Geology, in two Volumes.

The first a report of progress an synopsis of the fields north, from 1860 to 1864, contains Geology of the Coast Range, Geology of the Sierra Nevada, with an appendix, Description of the Fossils of the Auriferous Slates of California, by F. B. Meek.

The second volume contains the Geology of the Coast Range.

Detailed description of Monte Diablo coal fields, Coal of Southern California, etc.

Notes on Geology of Lower California.

The other reports of this Survey include a Volume on Barometric

Hypsometry , with tables—Cambridge, 1874, with supplement in 1878.

Two Volumes on Botany, by W. H. Brewer, and Sireno Watson.

Two Volumes on Ornithology, with geological maps of San Francisco Bay; also map of California and Nevada.

To these reports should be added a report on the fossil plants of the auriferous gravel deposits, by Leo Lesquereux, and Auriferous Gravel of the Sierra Nevada, by J. D. Whitney, with the climate Changes of Late Geological Times: all published in the memoirs of the Museum of Comparative Zoology, at Cambridge.

The survey was stopped by the Legislature in 1874, permission having been given to the State Geologist by the Board of Regents of the University of California to continue the publications.

The California State Mining Bureau was created by an act of the Legislature, approved April 16, 1880, and Henry G. Hanks appointed by the Governor in 1880, as State Mineralogist.

The first Annual Report, June 1st to Dec. 1st, 1880, contained analysis of clay from Placer County.

The second, Dec. 1st, 1880 to Oct. 1st, 1882, 288 pp., and 4 photographs, with appendix. This report contains various papers on mining, general geology, iron ores, mud volcanoes of the Colorado Desert, etc. The appendix has a paper on Forest Trees of California, by A. Kellogg; notes on hydraulic mining, etc., rare minerals recently found in the State, by Wm. P. Blake.

The miscellaneous publications include contributions to Geology and Mineralogy of California, by Wm. P. Blake, 15 pp., 1881; also a paper on the Milling of Gold Quartz, by M. Attwood, 20 pp., 1882.

Catalogues of the State Museum, Vols. 1 and 2, also catalogue of books and maps in the library of State Museum.

The 3rd Annual Report, for the year ending May 15, 1884, contains a report on the borax deposits.

The 4th Annual Report, for the year ending May 15, 1884, contains a general account of the Agricultural, and other resources, etc,,of California; also Catalogue of Minerals of California.

The 5th Annual Report, for the year ending May 15, 1885, 235 pp.;during this year the State Collection of Minerals was sent to the World's fair, at New Orleans, in charge of the State Mineralogist.

The 6th Annual Report, for the year ending June 1, 1886, Part 1: This report contains an article on San Diego Co., etc.

Henry G. Hanks resigned his office, May 13, 1886, and William Ireland waas appointed in his place.

The publications under William Ireland, State Mineralogist, consisted of the 2nd Part of 6th Annual Report, containing reports on the mines of Amador, Butte, and other counties.

Vol. 3, Catalogue of State Museum.

The 7th Annual Report, for 1887, contains articles on petroleum, asphaltum, and natural gas, etc., with a catalogue of fossils, by J. G. Cooper. This article forms Part 1 of the series; others were published in Bulletins.

The 8th Annual Report, for 1888, contains the mineral resources of the State, considered by counties.

Bulletin No. 1, a description of the desiccated human remains, by Winslow Anderson.

9th Annual Report, for 1889:

Contains articles on the Geology of the Islands off the Coast of California; account of San Diego County, etc.

The use of fossils to indicate mineral formation, by J. G. Cooper, etc.

The 10th Annual Report, for 1890:

Contains a geological map of the State, Geology of the Mother Lode, by H. W. Fairbanks.

Geological features of Placer, Nevada, Colorado Desert, Trinity, Orange Counties, etc.

During the year 1880, Vol. 4 of the Catalogues of the State Museum, with one on the Library, were issued.

The 11th Report, for two years, ending Sept. 15, 1892:

Contains special articles on Geology, including that of San Bernardino County.

Under the administration of J. J. Crawford, State Mineralogist, the following publications were issued, viz.:

The 12th Annual Report, for two years, ending Sept. 15, 1894. This report contains articles on the auriferous conglomerates, etc.; Geology of Ventura, Santa Barbara, and other counties, by H. W. Fairbanks.

This Report was followed by a number of Bulletins—Bulletin No. 2, Methods of Mine Timbering, with a second edition.

Bulletin No. 3, Gas and Petroleum-yielding Formations.

Bulletin No. 4, Catalogue of Fossils, Parts 2, 3, 4 and 5.

Bulletin No. 5, Cyanide Process; Catalogue of West North American Shells.

Bulletin No. 6, California Gold Mill Practices.

Bulletins Nos. 7 and 8, tables showing by Counties, the mineral productions of the State. No. 9, Mine Drainage Pumps, etc. No. 10, Bibliography of books relating to Geology of California, republished as Bulletin No. 30, including a list of the maps of California. No. 11, Oil and Gas-yielding Formations.

The 13th Report, for 1896, contains various articles on minerals, also mineral springs of the several counties, with appendix.

Under the administration of A. C. Cooper as State Mineralogist, th efollowing publications were issued:

Bulletins Nos. 12, 13, 14 and 17, showing by counties, the mineral productions of the State. No. 16, the Genesis of Petroleum. No.17, the Mineral Productions of the State. No. 18, The Mother Lode regions, general geology of the gold belts, methods of mining, etc.

Bulletin No. 19, Oil and Gas-yielding Formations of California, with Atlas of Maps.

Bulletin No. 20, a compendium of the mining industry of the State, for the four years ending September, 1900.

Bulletins Nos. 21 and 22, relate to the mineral production of each county.

The State Mining Bureau has issued and has in preparationu several valuable papers showing the different mines in the several counties. These pamphlets include a map of each county.

The following has been published: Register of mines and mining with maps of Plumas, Calaveras, Siskiyou, Nevada, Lake, Placer, El Dorado, Shasta, San Bernardino, Tuolumne, Sierra, Los Angeles, Amador, and Trinity Counties.

There are also several special bulletins, such as Bulletin No. 23, reports on Copper; Bulletin No. 24, on Saline Deposits; Bulletin No. 27, on Quicksilver. Gold Production of Cal., 1848-1903.

In the Assembly Documents there are several papers relating to mines and minerals. The Transaction of the Agricultural Society, for 1863, gives a list of gold mines, pp. 101-118, with Mining Review for 1863.

Senate Doc. 16, Session 1866, Vol. 3, gives an account of California Marble, with Mining Review for 1865.

Senate Doc. 17, Session No. 3, 1867, gives an account of gold, silver, etc.

The State University has published Report on Mount Diablo, by S. B. Christy, in Report of President, of Universiey for 1877.

In the Reports of the Regents, there are papers on the genesis of the cinnabar deposits, by S. B. Christy; Berkeley, 1878.

List of earthquakes, Report for 1887.

Building Stones, Report for 1883.

List of printed maps, Bulletin No. 9, 1887.

The University has published three Volumes and part of another, under the title of University of California, Bull. Dept. of Geology. The Bulletins contain special reports on the Geology of Carmelo Bay; Geology of Angel Island, The Great Valley of California, Geology of Point Sal, Topographic Study of the Islands of Southern California.

Geology of Point Reyes Peninsula, The Berkeley Hills, Quaternary of Southern California, with several papers on minerals and fossils.

There is also a Bulletin of the type Specimen in the Geological Museum figured in Whitney's reports.

. . In the various scientific serials, many articles on California appeared, in a long list of some forty publications. We have only space to note in general the more important papers.

In the proceedings of the American Association for the Advancement of Science, Wm. P. Blake, writes on the Probable Age of the San Francisco Sandstone, in 1855.

Prof. Joseph Le Conte, in his address for 1893, discusses the theories of the origin of mountain ranges.

In the proceedings for 1895 and 1896, J. P. Smith, of Stanford University, notes the Carboniferous Strata of Shasta County and metamorphic series of that region.

In the American Journal of Conchology, there is a long controversy regarding the Cretaceous and Eocene formation of California, between Conrad, and Gabb.

Conrad refers the Tejon rocks to the Eocene, and Gabb, to the Upper Cretaceous.

In the American Naturalist, there are papers on the Glacial formations of the Pacific and Atlantic slopes.

Remarks on fossil shells of Colorado Desert, also a paper on the hillocks or mounds formation of San Diego, by Geo. C. Barnes, etc.

The American Geologist contains papers by Joseph Le Conte, on the Flora of the Coast Islands, Vol. 1, 1888.

Papers by J. S. Diller, on Lavas of the Sierra Nevada Mountains.

Geology of the Mother Lode, by Fairbanks; with a paper on the Eocene, Cretaceous and Carboniferous rocks of California.

There are also several articles by H. W. Turner on the Sierra Nevada and Coast Ranges.

In the first series of the *American Journal of Science,* as early as 1839, Conrad has an article on the elevation of California during the Tertiary epoch.

There is also an early account of the Cinnabar Mines, in 1848.

The gold discovery during this year, 1848, was reported upon by Rev. C. S. Lyman.

The Quicksilver Mines, and Earthquakes, were subjects of papers by Wm. P. Blake in 1854.

The Volcanic Springs of Colorado Desert, by John J. Le Conte, in 1855.

In the other *Journals,* for 1855-58, there are articles of the gold regions of California; also papers on the earthquakes, by Dr. J. B. Trask.

The leading papers in the *Journals* of 1859-65, are those of Lesquereux on fossil plants. Silliman's papers on Quicksilver Mines and Petroleum, with a notice of the Geological Survey of California, by J. D. Whitney.

In 1866-70, Whitney published a paper on the Borax of California. W. H. Brewer wrote papers on alleged discovery of an ancient skull, also one on gold-bearing rocks. Gabb and Conrad on the Cretaceous subdivisions of the California Geological Survey.

Blake, in Vol. 45, for 1868, refers the gold-bearing rocks of California to the Carboniferous age.

In Vol. 1, 1871, Clarence King publishes a paper on the discovery of actual glaciers on the Mountains of the Pacific slope.

Prof. Le Conte, papers on the theory of formation of great features of the earth's surface, appeared in Vols. 4 and 5, for 1872-73.

In the Volumes for 1873 to 1876, there are various papers on glaciers, lava flows, auriferous gravel deposits of Gold Bluff. Formation of Coast Ranges, by Joseph Le Conte; Age of the Tejon group, by J. G. Cooper, etc.

In the Volumes for 1878-80, Dr. Le Conte has an article on the

Structure and Origin of Mountains, with other papers on volcanoes about Lake Mono, and the old river beds, etc.

Vols. 24-25, for 1882-83, contains Le Conte's papers on Metalliferous Vein Formation.

Some notes on the Jurassic Strata of North America, by Charles C. White, appear in Vol. 29, for 1885.

George F. Becker, writes on the Cretaceous Metamorphic Rocks of California, Vol. 31, 1886. With another paper in same volume on the Texture of Massive Rocks.

There is an article by Joseph Le Conte, in Vol. 34, 1887, on the Flora of the Coast Islands of California, in which he discusses the physical changes af the Coast region, as indicated by the Flora and Fauna of the Coast Islands.

In Vol. 40, 1890, J. S. Diller writes on the Cretaceous Rocks of Northern California.

During the years 1893-95, several papers appeared in the *Journal.* One, on the so-called Wallala beds, by Fairbanks. Notice of the discovery of Devonian rocks, in California, by Diller and Schuchert, Vol. 47, 1894.

An auriferous conglomerate of Jurassic age, from the Sierra Nevada, by W. Lindgren, Vol. 48, 1894.

Lower Cambrian Rocks of Eastern California, by Charles D. Walcott, Vol. 49, 1895.

There is a notice of some Mesozoic plants from Oroville, by Fontain, in Vol. 2, 1896.

The Granitic Rocks of Pyramid Peak, by Lindgren, Vol. 3, 1897.

Also the papers by Fairbanks, on Contact Metamorphism, and on Tin Deposits at Temescal, in Vol. 4, for 1897.

In the publications of the New York Academy of Sciences, there is an article on the Infusorial Deposits, also a Catalogue of the Shells Collected at Panama, by C. B. Adams, published in the Annals of the Lyceums, Vol. V, 1852.

The Transactions of the American Institute of Mining Engineers, contains important mining notes regarding California, with the geographical distribution of mining districts in the United States, by R. W. Raymond, Vol. 1, 1873.

The Bulletins of the Geological Society of America, containing the following papers in reference to California:

1. Orographic Movements of the Rocky Mountains—Emmons.
2. Sandstone Dikes—Diller.
3. Structure of a Portion of the Sierra Nevada—Becker.
4. Antiquities from Under Tuolumne Mountains—Becker.
5. Early Cretaceous of California and Oregon—Becker.
6. Tertiary and Post-Tertiary Changes of the Atlantic and Pacific Coasts—Le Conte.
7. Geology of Mount Diablo—Turner.
8. Geology of Taylorville Region—Diller.
9. Jura and Trias at Taylorville—Hyatt.
10. Stratigraphy and Succession of the Rocks, Sierra Nevada—Mills.
11. Cretaceous and Early Tertiary—Diller.
12. Faunas of the Shasta and Chico Formations—Stanton.
13. Two Neocene Rivers of California—Lindgren.
14. Age of Auriferous Slates—Smith.
15. Trias and Jura of Western States—Hyatt.
16. Shasta-Chico Series—Diller and Stanton.
17. Geological Sketch of Lower California—Merrill.
18. Review of Geology of California Coast Range—Fairbanks.
19. Characteristic Features of Gold Quartz Veins—Lindgren.
20. Fauna of Shasta Group, Etc.—White.
21. Earth Crust Movements—Le Conte.
22 Precambrian Fossiliferous Formations—Walcott.
23—Ground Sloths—Merriam.
24. Drainage Features of California—Lawson.
25. Geology of Great Basin—Turner.
26. Sketch of Pedological Geology—Hilgard.
27. Sierra Madre, Near Pasadena—Claypole.
28. Origin and Structure of Basin Ranges—Spurr.
29. Drainage Features of California—Lawson.
30. Geology of the Great Basin in California and Nevada—Lawson.
31. Geological Section of the Middle Coast Ranges—Lawson.

The California Academy of Sciences, established in 1854, publishes a series of articles on the geology, fossils, mineral and other resources of California. The most important articles are the following:

The Natural System of Volcanic Rocks, by Baron Richthofen, Memories, Vol. 1.

The first Volume of the Proceedings for 1854-57, contains notes on fossils and earthquakes, also a paper on the mud volcanoes of the Colorado Desert.

Vol. 2, Earthquakes in California, in 1858-59, by Dr. Trask.

The 3rd Volume has several papers on fossils, notes on earthquakes, with a paper by W. P. Blake on oil regions in the Tulare Valley; also miscellaneous notices by the same author.

The 4th Volume gives notes on the ancient glaciers, with geology of the Coast of Oregon, etc.

The writers in the 5th Volume, are Whitney—Auriferous Gravel Deposits in Placer County. Davidson—Abrasions of the Continental Shores of Northwest America.

Chase—Artesian Wells of Los Angeles County.

Davidson—Auriferous Gravel Deposits.

Goodyear—High Sierra, South of Mount Whitney.

Le Conte—Great Lava Flood of the Northwest.

Dall—Tertiary Fossils.

Cooper—California Coal, with papers on the Pliocene, Miocene, Eocene and Tertiary formations of California.

The 6th Volume contains several papers by J. G. Cooper, on West Coast Pulmonata fossils and living, continued from Bulletin No. 8.

Notes on Geology of Lower California, by Lindgren.

There are no geological papers in the second Volume.

Volume 3, has an article on the flexure of rocks, by George H. Ashley.

A list of the books relating to the Geology of California, by Vogdes, with a note on discovery of *Proctus ellipticus,* in the Carboniferous of Shasta County.

Vol. 4, Pliocene Fresh Water Shells—Cooper.

Neocene Stratigraphy of the Santa Cruz Mountains—Ashely.

Fossil and Sub-Fossil Shells of the U. S.—Cooper.

The Washoe Rocks—Becker.

The 3rd Series of the proceeding contains Geology of Santa Catalina Islands—Smith.

Submerged Rocks of the Coast—Davidson.

Several papers by J. P. Smith, on Ammonites.

Tertiary Sea Urchins—Merriam.

Formanifera—Chapman.

Palaeontology and Stratigraphy of the Marine Pliocene, Vol. 3—Arnold.

There are many other scientific publications containing articles of value to the student of California resources, such as *Engineering and Mining Journal*, Harvard University publications, *Mining Magazine, Mines and Minerals, Nature*, Philadelphia Academy publications, etc., which, owing to the length of this address, can only be noted.

In the *Journal of Geology*, there are a series of articles by J. P. Smith, on the Carboniferous and Metamorphic Formation of Shasta County.

The Age and Succession of the Igneous Rocks of the Sierra Nevada—Turner. Vol. 3, No. 4, 1895.

Stratigraphy of Coast Ranges—Fairbanks. Vol. 3, No. 4, 1895.

Migration of Marine Invertebrates—Smith. Vol. 3, 1895.

Fauna of Independence Hill—Knowlton. Vol. 4, 1896.

Age of Auriferous Gravel—Lindgren. Vol. 4, 1896.

Classification Marine Trias—Smith. Vol. 4, 1896.

Topography of California—Drake. Vol. 5, 1897.

Geology, San Francisco, Peninsula—Fairbanks. Vol. 5, 1897.

Geology, Martinez Group—Merriam. Vol. 5, 1897.

Post-Pliocene Elevation of Inyo Range—Walcott. Vol. 5, 1897.

Pliocene Skull, of California, Table Mt.—Blake. Vol. 7, 1899.

Replacement of Ore Deposits, Sierra Nevada—Turner. Vol. 7, 1899.

Principles of Palaeontologic Correlation—Smith. Vol. 8, 1900.

Drainage Features of California—Lawson. Vol. 9, 1901.

Geology of Great Basin—Turner. Vol. 9, 1901.

Sketch of Geology, Salinas Valley. Vol. 9, 1901.

The West American Scientist, published in San Diego, contains New Cretaceous Fossils, No. 21, pp. 28-31.

Minerals and Mines of San Diego, No. 23, with several articles by Dr. L. G. Yates, on Fossil Botany.

In Zoe, there appears a short article on the Geology of Farallones, by Blankenship.

In Mofras' Exploration des Territoire de l'Oregon des Californies, etc., Paris, 1844, there is a notice of the bitumen near Los Angeles, on p. 337, Vol. 2.

I—A. W. VOGDES

A Bibliographical Sketch of Doctor John B. Trask

II—F. W. KELSEY

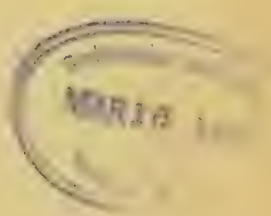
Mollusks and Brachiopods Collected in San Diego, California

III—HENRY HEMPHILL

Note on the Genus Haliotis

IV—A. W. VOGDES

The Genus Encrinurus



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DOCTOR JOHN B. TRASK

First State Geologist of California

A BIBLIOGRAPHICAL SKETCH OF DOCTOR JOHN B. TRASK

FIRST STATE GEOLOGIST OF CALIFORNIA

BY

ANTHONY W. VOGDES

SAN DIEGO, CALIFORNIA

Doctor John B. Trask was born at Roxbury, Massachusetts, in 1824, and died at San Francisco, California, July 3rd, 1879, in the 55th year of his age. He was one of the charter members of the Academy of Natural Sciences of San Francisco and contributed many papers to the Academy. His last paper was read before the Academy February 19th, 1866; afterwards, though always interested in the welfare of the Academy, he ceased to take an active part, and devoted his time to the practice of medicine, in which he was professionally skilled, and remarkable for originality and independent thought.

Through him the medical professions of the Pacific coast were first made acquainted with the mode of preparation of Mentel's Aluminated solution and other valuable styptics.

Doctor Trask paid early attention to the medical flora of the Pacific and made known or discovered the virtues of such plants as *Yerba santa*, for rheumatism, etc., *Damiana*, a nerve tonic, and *Grindelia robusta*, for oak poisoning, and other plants.

The first Pacific medical journal published in California was edited by Dr. Trask, in conjunction with Dr. Wooster, under the title of the "Pacific Medical and Surgical Journal," in the year 1858. After some years of laborious editorial work the journal passed out of his hands.

Doctor Trask was licentiate of Yale University, passing examinations in Geology, Mineralogy, Chemistry, Medical Botany and cognate sciences, and was subsequently honored by the *ad eundem* degree in the year 1859.

He was also the subject of honorable recognition by various European and American scientific societies, with honorary degrees from Italian and German colleges, awarded for his researches and discoveries in Organic Chemistry, Mineralogy, Microscopy and Medical Botany.

Personally, Dr. Trask was remarkable for originality and independent thought, earnest and generous-hearted, free from the acquisitive instinct,

and always ready to serve those who needed his services, without money and without price; he had many opportunities for pecuniary advancement, but neglected them.

He was as careless in such matters as in his dress. Direct and blunt of manner, some thought him rough and rude of speech; he was, nevertheless, sympathetic and ever ready to lend a helping hand or do a kindly deed. He was a man of strong convictions and decided in his opinions.

He was connected with the Mexican Boundary Survey as Geologist of California and the State of Nevada, also State Geologist of California in the early fifties.

He served in the war as Assistant Surgeon of Volunteers.

LIST OF GEOLOGICAL AND PALÆONTOLOGICAL PUBLICATIONS:

Dr. John B. Trask contributed to the California Academy of Sciences the following papers:

1—Description of new species of Naiades from Sacramento River; Proc. Cal. Acad. Sci., vol. 1, p. 27–29, 1855; *Anodonta Randalli*, *A. triangularis*, *A. rotundovata*. The second paper describes species from the Yuba River, *Alasmodon yubaensis*.

2—Description of *Ammonites Batesii*; Proc. Cal. Acad. Sci., vol. 1, p. 39, 1855.

3—Description of Fossil Shells; Proc. Cal. Acad. Sci., vol. 1, p. 40, 1855; *Chemnitzia papillosa*, *Tornatella elliptica*, *Murex fragilis*, *Fusus Barbarensis*, *F. robustus*, *F. rugosus*.

4—Earthquakes in California from 1812 to 1855; Proc. Cal. Acad. Sci., vol. 1, p. 85, 1856.

5—Descriptions of new species of Ammonite and Baculite from the Tertiary rocks of Chico creek; Proc. Cal. Acad. Sci., vol. 1, p. 92, 1856; *Ammonite Chicoensis*, *Baculite Chicoensis*.

6—Description of three new species of the genus Plagiostoma from the Cretaceous rocks of Los Angeles; Proc. Cal. Acad. Sci., vol. 1, p. 93, 1856 (plate); *Plagiostoma Pedrona*, *P. annulatus*, *P. truncata*.

7—On Earthquakes in California in 1856; Proc. Cal. Acad. Sci., vol. 1, p. 102, 1856.

8—On the direction and velocity of the Earthquake in California January 9th, 1857; Proc. Cal. Acad. Sci., vol. 1, p. 109, 1857.

9—On some new Microscopic Organisms; Proc. Cal. Acad. Sci., vol. 1, p. 110, 1857. In which he establishes the new genus *Leptosiagon* for certain forms attached to Algæ of Santa Barbara.

10—New species of Zoophytes; Proc. Cal. Acad. Sci., vol. 1, p. 112, 1857. In which the author describes nine new species from the Bay of San Francisco and adjacent localities.

11—Earthquakes in California during the year 1857; Proc. Cal. Acad. Sci., vol. 1, p. 121, 1858.

12—Earthquakes in California during 1858, 1859 and 1860; Proc. Cal. Acad. Sci., vol. 2, pp. 39 and 90, 1859-60.

13—Earthquakes in California in 1863 and 1864; Proc. Cal. Acad. Sci., vol. 3, p. 131, 1864.

14—Earthquakes in California from 1800 to 1864; Proc. Cal. Acad Sci., vol. 3, p. 131, 1864. Also published as a pamphlet at San Francisco 1864, 26 pp.

15—Earthquakes in California during 1864; Proc. Cal. Acad. Sci., vol. 3, p. 190, 1865.

16—Earthquakes in California during 1865; Proc. Cal. Acad. Sci, vol. 3, p. 239, 1866.

By resolution of the State Senate, passed March 26, 1853, Dr. Trask was called upon for such information as he may possess relative to the Geology of California and productive resources of the State. This report, of which only 2,000 copies were printed, is entitled:

1—Report of 1853, Geology of the Sierra Nevada or California Range, by John B. Trask, Sacramento, 1853, 31 pp.

It contains a sketch of the Geology and Mineral resources of the Eastern valleys of the Sacramento and San Joaquin, and to the Coast line within 41st and 42nd degrees of north latitude, from personal observations made during the years 1850-52.

Reviewed Mining Mag. 1853, vol. 1, pp. 6-23.

2—Report on the Geology of the Coast Mountains, embracing their Agricultural resources and Mineral productions, also portion of the Middle and Northern Mining Districts, by Dr. John B. Trask, State Geologist, Senate Doc. No. 14, Sacramento, 1855, 95 pp.

This report contains a description of the physical geography of the Coast Mountains. Geology of the Coast Mountains. Tertiary rocks of the Coast Mountains, Primitive rocks of the Coast Mountains. Volcanic rocks of the Coast Mountains. Geology of the San Bernardino Mountains, Stratified rocks of the San Bernardino chain of Los Angeles. Artesian borings. Soil and productions of Los Angeles. Mineral productions of Los Angeles. Country north of the American River. Mineral district of the Upper Sacramento Valley. Geology of the northern mountains. Local geology of the Northern Coast Mountains. Carboniferous limestone of the eastern part of Shasta County. Trinity County. Structure of the Sacramento Valley. Tertiary rocks and other deposits of the Sierra Nevada. Placer Mining. Quartz veins. Quartz Mines, with description of the mines and statistics.

3—Report on the Geology of the Coast Mountains and part of the Sierra Nevada, embracing their industrial resources in agriculture and mining, by John B. Trask, State Geologist, Assembly Doc. No. 9, 1854, 92 pp.

Contains a description of the Geology of the Monte Diablo range. Salinas Valley, from Point Pinos to the Nacimiento River. Santa Cruz Mountains. Structure of the valleys of the Sacramento and San Joaquin.

Review of the geological changes in the Coast Mountains and Monte Diablo ranges. Classification of the rocks of the Coast Mountains and Monte Diablo ranges. Position and relation of the Volcanic rocks of the Tertiaries. Volcanic rocks preceding the Tertiary era. Most recent volcanic rocks of the Coast Mountains. Changes of level and river terraces. Soils of the Santa Clara valley and shores of the Bay of San Francisco. Valley of the Salinas. Soils of the Salinas, Pajaro Valley, Livermore Valley. Mineral resources of the Coast Mountains. Mineral districts, embracing parts of the counties of Nevada, Placer, El Dorado and Calaveras. Quartz veins and their relative age in California. Character and position of the older veins below the surface. Present government of metallic veins. Description of the mines, with a list of gold mines.

4—Report on the Geology of Northern and Southern California, embrac- the Mineral and Agricultural resources of those sections, with Statistics of the Northern, Southern and Middle Mines, by Dr. John B. Trask, Assembly Doc. No. 14, Session of 1856, 66 pp.

Contains a description of the Physical geography of the Coast Mountains, lying north of the Bay of San Francisco. Geological structure of the Coast Mountains. Mineral character of the Primitive rocks of the Coast Mountains. Soils of Petaluma County. Plains west of the Sacramento River. San Bernardino. Geology of Table Mountain, Tuolumne County. Carboniferous rocks of the northern district. Salines of the Upper Sacramento Valley. Description of mines, etc. Analyses of Saline waters from Lick Springs, Shasta County. Gold mines in operation in 1855. Table of altitudes.

5—Report on the Geology of the Sierra or California Ranges, by John B. Trask; Pharmaceutical Journal, vol. 14, 1855, pp. 20–24.

MOLLUSKS AND BRACHIOPODS COLLECTED IN SAN DIEGO, CALIFORNIA.

BY F. W. KELSEY.

For the benefit of collectors of Mollusca and Brachiopoda, the author has compiled, as nearly as possible, a complete list of recent marine species to be found at San Diego, California.

The species listed have been collected within a district bounded by a a coast line not exceeding twenty-five miles in length, and in but a few instances going beyond a depth of two hundred fathoms.

San Diego is so situated as to afford special advantages to the collector of mollusks, as a great variety of collecting ground is accessible within a limited area, and the climate is so mild as to make collecting not only possible, but pleasant at all times of the year.

San Diego Bay affords an unusually interesting as well as prolific field for the conchologist, owing to the variety of ground awaiting his conquest.

At extremely low tides the nature of the ground uncovered ranges through all stages from a black, oozy mud, at the head of the bay, to the white beach sand at its entrance.

The grass flats opposite La Playa, are found well stocked with ever-varying sea life, and it is extremely interesting to note the changes in the molluscan population, as one species after another finds its way into the sheltered portions of the bay, becoming numerous today and tomorrow disappearing again.

On the Government Reservation, at the northern end of the bay, at a point about midway between Quarantine Station and Ballast Point, is a colony of rock borers, several species of which inhabit the sandstone left bare at middle tide; while still lower, among the moss-covered rocks, we find numerous Chitons and several species of Ocinebra, Muricidea, Pleurotoma and Odostomia.

The coarse gravel of Ballast Point contains its share, but gives it up only after hard labor; for the toothsome clam seems to be aware of the fact that he is popular, and the collector generally earns the savory dinner which he carries home in his basket.

The rocks of the Government Jetty are alive with rock dwellers, including many species of Littorina, Chlorostoma, Acmaea, Purpura,

Haliotis, Crepidula and others, while the ribbon kelp attached to the rocks carries several species that find shelter among its leaves.

The "marine ways," too, contribute their share of treasures, some of which, however, are introduced, as many small schooners from the southern coast come here to have the grass, barnacles and other foreign matter scraped off their hulls. This material furnishes a shelter for small mollusks, some of which are found among the debris.

Probably the most interesting method of collecting, and without doubt the one most costly, both in money and in labor, is securing the shells by means of the dredge and trawl. Both Dr. Fred Baker and I have done a great deal of this during the past five years, and have quite thoroughly covered an area of about thirty square miles of water, in the form of a semi-circle, with the entrance to San Diego harbor as a center.

The area so covered ranges from five to seventy fathoms in depth, and the species obtained have been quite numerous, including several new ones, and many others quite rare.

Personally I have dredged, with a good deal of care, all portions of the bay having over three fathoms of water, and have obtained very satisfactory results.

In the following list, which contains 554 species and named varieties, over 500 are at the present time in the author's collection, while the remainder are in the collections of Dr. Fred Baker, the Marine Biological Association of San Diego, and the National Museum at Washington, or are listed from C. R. Orcutt's list, published in the Proceedings of the National Museum in 1885; Philip P. Carpenter's list, published in 1872, and various publications mentioned in the explanatory notes.

The author has received the valuable assistance of Dr. William Healey Dall, Dr. Paul Bartsch and Dr. Fred Baker, in the identification of species.

The Nudibranchs are taken from a list prepared by Professor MacFarland, of Stanford University.

The list has been arranged alphabetically for ready reference, but for further convenience an index of genera and sub-genera has been provided, the same being arranged in the order adopted by Tryon in his Structural and Systematic Conchology.

Acanthochites avicula,

Var. diegoensis.. ..... Pils.

Acmaea asmi ..... Mid.

depicta ..... Gld.

Found on eel grass in sheltered localities.

incessa ..... Hds.

instabilis.. ..... Gld.

Acmaea mitra ..... Esch
paleacea ..... Gld.
Dead shells, numerous on beaches.
patina ..... Esch.
pelta ..... Esch.
pelta, var. elevata ..... Esch.
pelta, var. nacelloides ..... Dall.
On ribbon kelp at Government Jetty.
persona ..... Esch.
rosacea ..... Cpr
This species is quite rare here, although it is occasionally dredged or thrown upon the shore among drift.
scabra ..... Nutt.
scabra, var. limatula ..... Cpr.
Admete gracilior ..... Cpr.
Dr. 52 fathoms.
Adula falcata ..... Gld
stylina ..... Cpr.
Beautifully marked little rock borers, having a rich brown epidermis.
Aeolis iodinea ..... Cpr.
opalescens ..... Cpr
Aesopus myrmecoön ..... Dall.
Dr. 5 fathoms.
chrysalloideus ..... Cpr.
Dr. 5 fathoms.
Alaba oldroydi ..... Dall
supralirata ..... Cpr.
Alabina turrita ..... Cpr.
Aldisa sanguinea ..... Cooper
Alvania purpurea ..... Dall.
Amiantis callosa ..... Conr.
One of the most beautiful of our bivalves; rare in San Diego, but occasionally found on sand beaches.
Amphisphyra subquadrata ..... Cpr.
Dr. 15 fathoms.
Amphissa corrugata ..... Rve.
undata ..... Cpr.
Dr. 50 fathoms.
versicolor ..... Dall.
Amphithalamus inclusus ..... Cpr.
Collected by Henry Hemphill, and mentioned in Bulletin of the Southern California Academy of Sciences, November, 1905.
Anomia lampe ..... Gray
Found occasionally on rocks, but very difficult to obtain in good condition, owing to the tenacity with which the delicate lower valve clings to the rock.

Aplysia californica ..... Cooper

A good example of an interesting class of mollusks, whose shell, when present, is concealed in the back of the animal, and can only be produced by dissection. This is the largest known species of sea hare.

Arca gradata ..... Sby.

Formerly known as Barbatia gradata, found attached by byssus to under side of mossy rocks at low tide.

solida ..... Sby

Dr. 13 fathoms.

Assiminea californica ..... Cooper

Asthenothaerus villosior ..... Cpr.

Dr. 5 fathoms. A delicate little bivalve, with a strong orange band around the edge of both valves; found abundantly in shallow dredging.

Astrælium inaequale ..... Mart.

Avicula sterna ..... Gld.

Introduced. Found at the "Marine Ways," where vessels from the south have been scraped and shells have been among moss and barnacles.

Axinea intermedia ..... Brod.

Dr. 10 fathoms.

Barleeia haliotiphila ..... Cpr.

Found concealed among barnacles, moss, etc., on large Haliotis shells.

subtenuis ..... Cpr.

" var. rimata ..... Cpr.

Bittium armillatum ..... Cpr.

Dr. 11 fathoms.

asperum ..... Cpr.

Dr. 5 fathoms.

interfossa ..... Cpr.

Dr. 12 fathoms.

quadrifilatum ..... Cpr.

Found plentifully on mud flats, at low tide.

rugatum ..... Cpr.

Dr. 50 fathoms.

Borcotrophon avalonensis ..... Dall.

Dr. 52 fathoms.

disparilis ..... Dall.

Proc. U. S. Natl. Museum, No. 1032, page 712.

eucymatus ..... Dall.

Proc. U. S. Natl. Museum, No. 1264, page 547.

Bulla nebulosa ..... Gld.

Found very plentifully on mud flats, at low tide, or crawling leisurely through soft mud in shallow water.

quoyi ..... Say.

Rare, but occasionally found at False Bay.

Bursa californica ..... Hds.
=Ranella californica, Hds.
Occasionally taken in fishermen's nets, or when spawning, in sand and mud of sandspits at the mouth of False Bay.

Cadlina flavomaculata ..... MacFarland
marginata ..... MacFarland

Cadulus californicus ..... Pils.
Dr. 160 fathoms.
fusiformis ..... Pils.
Dr. 60 fathoms.
nitentior ..... Cpr.
Dr. 5 fathoms.

Caecum californicum ..... Dall.
crebricinctum ..... Cpr.
Dr. 15 fathoms.
glabrum ..... Mont.
magnum ..... Stearns.
Dr. 15 fathoms.
orcuttii ..... Dall
Found under rocks, at low tide, at Pacific Beach and on Point Loma. These, like Caecum californicum, are generally found in colonies

Calliostoma annulatum ..... Mart.
canaliculatum ..... Mart.
" var. parvum ..... Williamson
gemmulatum ..... Cpr.
gloriosum ..... Dall.
splendens ..... Cpr.
supragranosum ..... Cpr.
Dr. 10 fathoms.
tricolor ..... Gabb.
turbinum ..... Dall.
The Calliostoma are found in considerable numbers nestling among the grass on the mud flats, at low tide. The last species is mentioned in the Proceedings of the U. S. National Museum, Vol. XVIII, p. 8.

Callistochiton crassicostatus ..... Pils.
decoratus ..... Cpr.
palmulatus ..... Cpr.
" var. mirabilis ..... Pils.

Calyptraea mamillaris ..... Brod.
Dredged.

Cantharidus (Halistylus) pupoideus ..... Cpr.
Dr. 5 fathoms.

Capulus californicus ..... Dall.
Discovered by Mrs. Oldroyd on the shell of the Pecten diegoensis, which is, I believe, its only habitat.

Cardita subquadrata.....Cpr.
=Lazaria subquadrata.

Cardium corbis.....Mart.
Rare, although found in considerable numbers farther south.

procerum.....Sowb.
This cardum, although formerly found alive here, is now only found in a sub-fossil condition on the shore of Spanish Bight.

quadrigenarium.....Conr.

Cavolinia inflexa.....Lesueur
Dr. 600 fathoms.

tridentata.....Gmel.
Dr. 120 fathoms.

trispinosa.....Lesueur
Dr. 400 fathoms.

Cerithidea californica.....Hald.
Formerly listed as Cerithidea sacrata, Gld. Found in great numbers on mud at middle tide, and on salt marshes.

californica, var. hyporhyssa.....Berry
Described in Nautilus, Vol. XIX, No. 12

Cerithiopsis assimilata.....C. B. Ads.

columna.....Cpr.

metaxae.....Della Chiaje.
Dr. 5 fathoms.

munita.....Cpr.
Dr. 8 fathoms.

purpurea.....Cpr.

tuberculata.....Mont.
Dr. 10 fathoms. These small forms, often found in drift, are very difficult to determine without the aid of a good glass.

Chaetopleura hartwegii.....Cpr.

lurida, Var. prasinata.....Cpr.
Dr. 75 fathoms. My specimen, found on a rock, drawn up on lines of fishermen.

nuttallii.....Cpr.

Chama exogyra.....Conr.

pellucida.....Sowb.
Quite common on rocks, often growing side by side, and only distinguishable to a casual observer by the difference in direction of the spiral turn of the upper valve.

Chione excavata.....Cpr.

fluctifraga.....Sby.

simillima.....Sby.

succincta.....Val.

Chlamydoconcha orcutti.....Dall.
A rare bivalve, discovered by Mr. Orcutt at False Bay. The shells are entirely concealed within the whitish, spongy portions of the animal.

Chlorostoma aureotinctum ..... Fbs.
brunneum ..... Phil.
funebrale ..... A. Ads.
" var. subapertum ..... Cpr.
gallina ..... Fbs.
" var. tinctum ..... Hemp
pfeifferi ..... Phil.
pulligo ..... Mart.
regina ..... Stearns
Nearly all the species of Chlorostoma are found in large numbers among the rocks at middle tide, and although inclined to colonize, several species are often found in the same locality.

Chorus belcheri ..... Hds.
Dredged. Quite common; generally drawn up in nets of fishermen.

Chromodoris californiensis ..... Bergh
macfarlandi ..... Cockerell
porterae ..... Cockerell
universitatis ..... Cockerell

Chrysallida acquiseulpta ..... Cpr.
helga ..... D. & B.
pumila ..... Cpr.

Chrysodomus eucosmius ..... Dall.
Proc. U. S. Natl. Museum, No. 1032, page 709.

Circe margarita ..... Cpr.
Dr. 15 fathoms.

Clathurella canfieldi ..... Dall.
Dr. 12 fathoms.

lowei ..... Dall.
Dr. 35 fathoms.

Clidiophora punctata ..... Cpr.
Dr. 10 fathoms. Live shells are rare, but single valves are often washed ashore after storms at Pacific Beach.

Clio pyramidata ..... Raug.
Dr. 400 fathoms.

Columbella (astyris) aurantiaca ..... Dall.
Dr. 3 fathoms.

carinata ..... Hds.
gausapata ..... Gld.
hindsii ..... Rve.
penicillata ..... Cpr.
subturrita ..... Cpr.
tuberosa ..... Cpr.
variegata ..... Stearns
Dr. 3 fathoms.

Conus californicus ..... Hds
Common, among rocks at low tide.
Cooperella subdiaphana ..... Cpr.
Formerly known as Oedalia, and Oedalina subdiaphana. Cpr.; found in mud, on flats, at low tide.
Corbula luteola ..... Cpr.
" var. rosea ..... Williamson
Dr. 5 fathoms.
Crassatella marginata ..... Cpr.
Dr. 12 fathoms.
Crassinella varians ..... C. B. Ads.
Dr. 15 fathoms.
Crenella columbiana ..... Dall.
Dr. 50 fathoms.
divaricata ..... Orb.
Dr. 50 fathoms.
Crepidula aculeata ..... Gmel.
aduncа ..... Sby.
This shell is found on the backs of other shells, and, like Capulus californicus, is marked by a beautiful pink color, unlike most of the other crepidulae.
arenata ..... Brod.
dorsata ..... Brod.
dorsata, var. lingulata ..... Gld.
excavata ..... Brod.
lessonii ..... Brod.
navicelloides ..... Nutt.
Generally found inside the orifice of larger shells.
navicelloides var. explanata ..... Gld.
onyx ..... Sby.
rugosa ..... Nutt.
Found in large numbers on other shells, notably on Bulla nebulosa and Conus californicus.
unguiformis ..... Lam.
Crucibulum spinosum ..... Sby.
Cryptomya californica ..... Conr.
Cumingia californica ..... Conr.
Found with Platyodon cancellatus, in soft sandstone, into which they seem to have burrowed like Pholads.
Cuspidaria californica ..... Dall.
Dr. 50 fathoms.
Cylichna albida ..... Brown
attonsa ..... Cpr.
Dr. 56 fathoms.
Cypraea spadicea ..... Swains.
This, our only local Cypraea, is found rarely, at False Bay.

Cythara branneri..... Arnold
Cytherea fordi..... Yates
Dr. 50 fathoms. In National Museum collection.
Dentalium neohexagonum..... Sharp & Pils
Dr. 5 to 8 fathoms.
vallicolens..... Raymond
Dr. 62 fathoms.
Diala marmorea..... Cpr.
Diaululua sandiegensis..... Cooper
Diplodonta orbella..... Gld.
Besides finding this shell in its cleverly constructed nest of mud, with tubes covering the siphons, I have found it cosily nested in the deserted shells of bivalves, like the Semele rupium, with a cushion of the same muddy nature, which fits the shell and prevents friction with the hard walls outside.
Donax conradi..... Desh.
culter..... Hanley
navicula..... Cpr.
Doriopsis vidua..... Burgh.
Doris alabastrina..... Cpr.
sandiegensis..... Cpr.
sanguinea..... Cpr.
Drillia cancellata..... Cpr.
Dr. 12 fathoms.
hemphilli..... Stearns
Dr. 4 to 5 fathoms.
incisa..... Cpr.
Dr. 30 fathoms.
inermis..... Cpr.
moesta..... Cpr.
Found plentifully on rocks at Quarantine, among green moss.
montereyensis..... Stearns
penicillata..... Cpr.
torosa..... Cpr.
" var. aurantia..... Cpr.
Dunkeria gracilenta..... Cpr.
laminata..... Cpr.
Dr. 8 fathoms.
Engina carbonaria..... Rve.
Dr. 13 fathoms.
Ensis californicus..... Dall.
Erato columbella..... Mke.
vitellina..... Hds.
Ervilia castanea..... Mont.
Ethalia invallata..... Cpr.
Dr. 6 to 8 fathoms.

Ethalia supravallata.....Cpr.
Dr. 6 to 8 fathoms.
Eulima bistorta.....Van.
Dr. 15 fathoms.
fuscostrigata.....Cpr.
Dr. 6 fathoms.
hastata.....Sby.
Dr. 3 fathoms.
micans.....Cpr.
Dr. 3 to 5 fathoms. Found quite commonly in shallow dredging.
rutila.....Cpr.
Dr. 2 to 3 fathoms.
solitaria.....C. B. Ads.
My specimens were among moss on large abalone shells.
Eulithidium substriatum.....Cpr.
A very beautiful little shell, resembling Phasianella compta, Gld.; var. pulloides, Cpr., but more globose and very thin.
Fissurella volcano.....Rve.
Very common on rocks at all points along the coast.
Frieleia halli.....Dall.
Dr. 100 fathoms.
Fusus kobelti.....Dall.
Dredged.
Gadinia reticulata.....Sby.
Gemma gemma.....Totten
Dr. 50 fathoms.
Gibbula optabilis.....Cpr.
parcipicta.....Cpr.
Dr. 50 fathoms.
Glottidia albida.....Hinds.
This little shell in many ways resembles a growing plant; the leaf-like valves come up through the mud, while the long appendage strikes down like a root to support the coming plant.
audebarti.....Brod.
Dr. 12 fathoms.
Glyphis aspera.....Esch.
densiclathrata.....Rve.
inaequalis.....Sby.
Haliotis assimilis.....Dall.
corrugata.....Gray
cracherodii.....Leach
" var. californiensis.....Swains
splendens.....Rve.
=H. fulgens, Phil.
Haminea vesicula.....Gld.
virescens.....Sby.

Heterodonax bimaculatus.....D'Orb.

This shell is found in a great many beautifully colored varieties, ranging from pure white to dark purple.

Hinnites giganteus.....Gray

Hipponyx antiquatus.....Linn.

cranoides.....Cpr.

tumens.....Cpr.

Hopkinsia rosacea.....MacFarland

Nautilus, Vol. XVIII., page 131.

Ianthina trifida.....Nutt

This beautiful Pacific species is not rare, frequently being washed ashore after storms.

Isapis fenestrata.....Cpr.

Dr. 8 fathoms.

obtusa.....Cpr.

Dr. 8 fathoms.

Ischnochiton clathratus.....Rve.

conspicuus.....Cpr.

Jeffreysia alderi.....Cpr.

translucens.....Cpr.

Kellettia kellettii.....Fbs.

=Siphonalia kellettii.

Kellia laperousii.....Desh.

" var. chironii.....Cpr.

suborbicularis.....Mont.

Lacuna solidula.....Lov.

unifasciata.....Cpr.

" var. aurantiaca.....Cpr.

Laila cockerelli.....MacFarland

Nautilus, Vol. XVIII., page 131.

Lamellaria diegoensis.....Dall.

Rarely found among grass at low tide.

stearnsii.....Dall.

Laqueus californicus.....Koch.

Dr. 108 fathoms.

Lasea rubra.....Mont.

" var. subviridis.....Cpr.

Numerous colonies of these ruddy little bivalves are found at low tides clinging to the rocks like a crust of little jewels.

Leda cuneata.....Hovley

Dr. 50 fathoms.

conceptionis.....Dall.

Dr. 62 fathoms.

hamata.....Cpr.

Dr. 56 fathoms.

taphria.....Dall.

Dr. 40 to 60 fathoms.

Lepidopleurus mertensi ..... Conr.
rugatus. ..... Cpr.
veredentiens ..... Cpr.

Lepton meroëum ..... Cpr.

Leptothyra bacula ..... Cpr.
carpenteri ..... Pils.
paucicostata ..... Dall.

Lima orientalis ..... Ad. & Rve.

Limatula subauriculata ..... Mont.
Dr. 52 fathoms.

Liocardium elatum ..... Sby.
substriatum ..... Conr.

Liotia acuticostata ..... Cpr.
fenestrata ..... Cpr.

Lithophagus aristatus ..... Dillwyn.
attenuatus ..... Desh.
plumula ..... Hanley
This genus consists of rock-boring bivalves that are only obtained by the exercise of much labor.

Littorina planaxis ..... Nutt.
scutulata ..... Gld.

Loligo stearnsii ..... Hemp.

Lottia gigantea ..... Gray
This limpet seems to love the dashing of the waves, and where the sea is wildest, there we find it in abundance on the rocks.

Lucapina crenulata ..... Sby.
The great keyhole limpet is at times quite abundant among the rocks at low tide, where its black, slug-like mass slowly drags itself through the tangles of sea-weed.

Lucapinella callomarginata ..... Cpr.
Quite rare, only a few specimens having been found here alive.

Lucina annulata ..... Rve.
californica ..... Conr.
nuttallii ..... Conr.

Lunatia lewisii ..... Gld.
Dr. 12 fathoms. A variety of the above is found here which so closely resembles Lunatia draconis as to be almost undistinguishable.

Lyonsia californica ..... Conr.
Dr. 5 fathoms.
inflata ..... Conr.
nitida ..... Gld.

Macoma inconspicua ..... B. & S.
indentata ..... Cpr.
" var. tenuirostris ..... Dall.
inflatula ..... Dall.
Dr. 20 fathoms.
nasuta ..... Conr.
secta ..... Conr.
yoldiformis ..... Cpr.
Dr. 20 fathoms.
Macron lividus ..... A. Ads.
Very common on the moss-covered rocks of Point Loma.
Mactra californica ..... Conr.
dolabriformis ..... Conr.
falcata ..... Gld.
nasuta ..... Gld.
Malletia californica ..... Dall.
Dr. 36 fathoms.
faba ..... Dall.
Keep's West American Shells, page 23.
Mangilia angulata ..... Cpr.
Dr. 10 fathoms.
fuscoligata ..... Cpr.
hamata ..... Cpr.
merita ..... Gld.
Dr. 5 fathoms.
nitens ..... Cpr.
Dr. 8 fathoms.
subdiaphana ..... Cpr.
Dr. 5 fathoms.
variegata ..... Cpr.
Marginella jewettii ..... Cpr.
Dr. 6 fathoms.
pyriformis ..... Cpr.
Dr. 5 to 6 fathoms.
regularis ..... Cpr.
Dr. 3 fathoms.
varia ..... Cpr.
Megatebennus bimaculatus ..... Dall.
Melampus olivaceus ..... Cpr.
Very numerous on the salt marshes kept moist by high tides, but seldom covered by water.
Mesalia californica ..... Dall.
Dr. 52 fathoms.
subplanata ..... Cpr.
Dr. 100 fathoms.
tenuisculpta ..... Cpr.
Dr. 3 to 5 fathoms.

Metis alta..... Conr.
Formerly known as Lutricola alta, Conr.

Milneria minima ..... Dall.

Miodon prolongatus..... Cpr.
Dr. 50 fathoms. Proceedings of U. S. Natl. Museum, Vol. XIII, page 217.

Miralda californica..... D. B.
notabilis..... C. B. Ads.

Mitra maura..... Swains.
This beautiful mitra, only rarely found alive on Point Loma.

Mitromorpha aspera..... Cpr.
filosa..... Cpr.

Modiolus capax..... Conr.
opifex..... Say.
politus..... Verrill.
Dr. 56 fathoms.
rectus..... Conr.

Monia macrochisma..... Desh.
Formerly known as Placunanomia macrochisma, Desh, a rare but handsome shell, showing rich color markings.

Monoceros engonatum..... Conr.
Found in large numbers among rocks at Government Jetty.
engonatum var. spiratum..... Blv.
lugubre..... Sowb.
pauciliratum..... R. E. C. Stearns.
Not uncommon in shallow pools, at middle tide, at Pacific Beach.

Mopalia hindsii var..... Dall.
muscosa..... Gld.

Mumiola cincta..... Cpr.
turricula..... De Folin.

Murex carpenteri..... Dall.
Nautilus, Vol. XII., page 123.
incisus..... Brod.
trialatus..... Sowb.
Rare and generally covered with green limey incrustation.

Muricidea barbarensis..... Gabb.
foveolata..... Hds.
These are rare, but a few fine specimens of the banded form have been found near Quarantine.

Mytilimeria nuttalli..... Conr.
Mytilus bifurcatus..... Conr.
californicus..... Conr.
Myurella simplex..... Cpr.

Nassa cooperi ..... Sby.
" var. mendica ..... Gld.
fossata ..... Gld.
insculpta ..... Cpr
Dr. 56 fathoms.
perpinguis ..... Hds.
Very common, showing great variety of color, including some fine banded forms.
tegula ..... Rve.
Navanax inermis ..... Pils.
Nettastomella darwinii ..... Sby.
Quite abundant in rocks at La Jolla, but so frail as to render it difficult to secure unbroken specimens.
Neverita recluziana ..... Petit.
Norrisia norrisii ..... Sby.
A beautiful species, generally found in the ribbon kelp that fringes the reefs on Point Loma, formerly known as Trochiscus norrisii, Sby.
Nucula bellotii ..... A. Ads.
Dr. 52 fathoms.
castrensis ..... Hds.
Dr. 60 fathoms.
exigua ..... Sby.
Dr. 15 to 20 fathoms.
Nuculina munita ..... Cpr.
50 fathoms.
Nuttallina californica ..... Nutt.
scabra ..... Gld.
Obeliscus conicus ..... C. B. Ads.
Ocinebra circumtexta ..... Stearns
" variety aurantia ..... Stearns
gracillima ..... Stearns
interfossa ..... Cpr.
" var. atropurpurea ..... Cpr.
" var. muricata ..... Cpr.
painei ..... Dall.
Dr. 75 fathoms. Beautiful specimens of this rare shell have been found by the author on a rock, hauled up on the lines of fishermen.
pauxillus ..... A. Ads.
poulsoni ..... Cpr.
Octopus punctatus ..... Gabb.
Odostomia amaura ..... D. & B.
americana ..... D. & B.
eucosmia ..... D. & B.
This species and the following from the Bulletin, Southern California Academy of Sciences, Vol. IV., No. 8.

Odostomia grammatospira ..... D. & B.
gravida ..... Gld.
montereyensis ..... D. & B.
nuciformis ..... Cpr.
subturrita ..... D. & B.
tenuis ..... Cpr.
tenuisculpta, var ..... Cpr.
turritominia ..... D. & B.
These minute mollusks are generally found in colonies, among or under rocks, at low tides, and in many cases cannot be determined without a lens.

Olivella biplicata ..... Sby.
Often found in great numbers at low tide; the colors ranging from pure glossy white, through light and dark gray, to dark brown
boetica ..... Cpr.
intorta ..... Cpr.
Dr. 12 fathoms.

Ommastrephes gigas ..... D'Orb.
Onphalius fusceseens ..... Phil.
Oscilla aequisculpta ..... Cpr.
insculpta ..... D. & B.
Ostrea amara ..... Cpr.
conchaphila ..... Cpr.
lurida ..... Cpr.
" var. expansa ..... Cpr.
The various species of Ostrea are found in considerable numbers on rocks, bottles, cans, pipes, and timbers, at low tide.

Ovula deflexa, var. barbarense ..... Dall.
Dredged. Generally found on a species of yellow gorgonia.

Panopea generosa ..... Gld.
Rarely found; burrowing in sand and mud to a depth of two feet or more. Formerly known as Glycimeris generosa, Gld.

Parapholas californica ..... Conr.
Parthenia amianta ..... Dall
Pecten aequisulcatus ..... Cpr.
diegoensis ..... Dall.
Dr. 8 fathoms. This fine species is occasionally pulled up by fishermen in their nets, and formerly called Pecten floridus, Hds.
latiauritis ..... Conr.
" var. paucicostatus ..... Cpr.
monotimeris ..... Conr.
These two species are very common, sometimes a single kelp plant having hundreds on its leaves.
vancouverensis ..... Whit.
Dr. 50 fathoms.

Pedipes unisulcatus ..... J. G. Cooper.
liratus ..... Cpr.
Periploma argentaria ..... Conr.
discus ..... Stearns.
Dr. 10 fathoms.
Petricola carditoides ..... Conr.
" var. californica ..... Conr.
denticulata ..... Sby.
ventricosa ..... Desh.
Phacoides approximatus ..... Dall.
Dr. 12 to 35 fathoms.
californicus ..... Conr.
richthofeni ..... Gabb.
tenuisculpta ..... Cpr.
Dr. 4 fathoms.
Phasianella compta ..... Gld.
" var. punctulata ..... Cpr.
pulloides ..... Cpr.
This pretty shell can generally be found in considerable numbers on the grass at low tide.
Philobrya setosa ..... Cpr.
Dr. 20 fathoms. Also known as Bryophila setosa.
Pholadidea ovoidea ..... Gld.
penita ..... Conr.
sagittata ..... Stearns
These fragile species are rock-borers and are difficult to obtain, but make pretty cabinet specimens. Found near Quarantine and at La Jolla.
Pholas pacifica ..... Stearns
Platidia anomioides ..... Scacchi.
Dr. 50 fathoms.
Platyodon cancellatus ..... Conr.
Plectodon scaber ..... Cpr.
Dr. 35 fathoms.
Pleurophyllidia californica ..... Cpr.
Pleurotoma carpenteriana ..... Gabb.
Dr. 60 fathoms.
catalinae ..... Raymond
Dr. 60 fathoms.
perversa ..... Gabb.
Dr. 82 fathoms.
santarosana ..... Dall.
Dredged.
stearnsiana ..... Raymond
Dr. 25 to 40 fathoms.
tryoniana ..... Gabb.
Dredged.

Pomaulax undosus ..... Wood.
Dr. 7 fathoms. A large, rough, conical shell, often thrown ashore after heavy storms; frequently carries smaller shells among moss which adheres to its epidermis.
Priene oregonensis ..... Redf.
Dredged.
Protocardia centifilosa ..... Cpr.
Dr. 50 fathoms.
Protothaca laciniata ..... Cpr.
staminea ..... Conr.
tenerrima ..... Cpr.
This genus was formerly listed as Tapes.
Psammobia edentula ..... Gabb.
californica ..... Conr.
Not common, but occasionally found at a depth of a foot or more at False Bay. The last species has formerly been listed as P. rubroradiata.
Psephidia ovalis ..... Dall
Dr. 50 fathoms.
Pteronotus festivus ..... Hds.
Pterorhytis foliatum ..... Gmel.
nuttallii ..... Conr.
This genus formerly listed as Cerostoma.
Punctulella cooperi ..... Cpr.
Dr. 56 fathoms.
cucullata ..... Gld.
Dr. 56 fathoms.
Purpura muricata ..... Hds.
ostrina ..... Gld.
Dredged.
saxicola ..... Val.
This species found abundantly among stones of Government Jetty, and furnish a fine illustration of variety in form and color marking.
Pyramidella californica ..... D. & B.
Rictaxis punctocaelata ..... Cpr.
Listed as Rhextaxis punctocaelata in Keep's "West American Shells."
Rissoa aequiseulpta ..... Cpr.
compacta ..... Cpr.
Rissoina bakeri ..... Bartsch.
Nautilus, Vol. XVI., No. 1.
kelseyi ..... Dall.
Dr. 7 fathoms. Nautilus, Vol. XVI , No. 8.
Rupellaria lamellifera ..... Conr.
Dr. 8 fathoms.
Sanguinolaria nuttalli ..... Conr.

Saxicava arctica ..... Linn.

rugosa ..... Linn.

These little bivalves, found among rocks, are very irregular in form—no two seeming to follow the same plan of structure.

Saxidomus nuttallii ..... Conr.

The young of this species has been known as Saxidomus aratus, Gld.

Scala ballastriata ..... Cpr.

Dr. 15 fathoms.

crebricostata ..... Cpr.

Dr. 20 fathoms.

crenatoides ..... Cpr.

hindsii ..... Cpr.

" var. tincta ..... Cpr.

lowei ..... Dall.

Dr. 40 fathoms.

sawinae ..... Dall.

Dr. 55 fathoms.

Scissurella kelseyi ..... Dall.

Nautilus, Vol. XVIII., page 124.

Semele decisa ..... Conr.

incongrua ..... Cpr.

Dr. 5 to 10 fathoms.

pulchra ..... Sby.

Dr. 8 fathoms.

rubropicta ..... Dall.

Dr. 3 fathoms.

rupium ..... Sby.

Fine specimens of the last species are found occupying the deserted burrows of rock-borers in the rocks at La Jolla.

Septifer bifurcatus ..... Rve.

Serpulorbis squamigerus ..... Cpr.

Serridens oblonga ..... Cpr.

This interesting little bivalve was found by the author nestling in the mantle of the Ischnochiton conspicuua. It was listed by Carpenter as Pristophora oblonga, named from a single valve in 1866.

Sigaretus debilis ..... Gld.

Siliqua lucida ..... Conr.

Siphodentalium quadrifissatum ..... Cpr.

Dr. 15 fathoms.

Siphonaria lecanium ..... Phil.

Solariella johnsoni ..... Dall.

nuda ..... Dall.

Dr. 400 fathoms.

peramabilis ..... Cpr.

Dr. 60 fathoms.

Solemya occidentalis ..... Desh.
Dr. 50 fathoms.
valvulus ..... Cpr.
Solen rosaceus ..... Cpr.
sicarius ..... Gld.
Sphenia fragilis ..... Cpr.
ovoidea ..... Cpr.
Dr. 5 fathoms.
Spiroglyphus lituella ..... Mörch.
Spisula catilliformis ..... Conr.
hemphilli ..... Dall.
planulata ..... Conr.
Formerly listed as Mactra.
Tagelus californianus ..... Conr.
subteres ..... Conr.
This genus = Solecurtus.
Tellimya tumida ..... Cpr.
Dr. 51 fathoms.
Tellina bodegensis ..... Hds.
buttoni ..... Dall.
Dr. 5 fathoms = Angulus obtusus, Cpr.
carpenteri ..... Dall.
Dr. 5 to 50 fathoms = Angulus variegatus. Cpr.
lamellata ..... Cpr.
Dredged. Proceedings of the U. S. Natl. Museum, Vol. XXIII., page 301.
meropsis ..... Dall.
= Tellina gouldi, Cpr.
santarosae ..... Dall.
Dr. 12 fathoms.
Terebra specillata ..... Hds.
Dr. 10 fathoms.
Terebratalia occidentalis ..... Dall.
Dredged.
transversa ..... Sby.
Dredged.
Terebratulina caput-serpentis ..... Linn.
Dr. 50 fathoms.
" var. unguicula ..... Cpr.
Dr. 20 fathoms.
Thalotia caffea ..... Gabb.
Thecacera velox ..... Cockeaell
Journal of Malachol, Vol. VIII., page 87.
Thracia curta ..... Conr.
Thyasira barbarensis ..... Dall.
Dr. 56 fathoms. Cryptodon barbarensis.

Tivela stultorum ..... Mawe.
=Pachydesma crassatelloides, Conr.
Tornatina carinata ..... Cpr.
cerealis ..... Gld.
culcitella ..... Gld.
Dr. 3 to 56 fathoms.
eximia ..... Baird
Dr. 56 fathoms.
harpa ..... Dall.
inculta ..... Gld.
planata ..... Cpr.
" var. attonsa ..... Cpr.
Trachydermon dentiens ..... Gld.
Transenella tantilla ..... Gld.
Dr. 10 fathoms = Psephis tantilla, Gld.
Tresus nuttalli ..... Conr.
=Schizothaerus nuttallii
Triforis adversa ..... Mont.
Tritonia palmeri ..... Cpr.
Trivia californica ..... Gray
solandri ..... Gray
This beautiful shell is rare, but fine examples have been found at La Jolla and Point Loma.
Truncatella californica ..... Pfr.
stimpsonii ..... Stearns
Turbonilla aurantia ..... Cpr.
Dredged.
castanea ..... Cpr.
chocolata ..... Cpr.
Dr. 12 fathoms.
gracilior ..... C. B. Ads.
Dr. 20 fathoms.
kelseyi ..... D. & B.
laxa ..... Dall.
lowei ..... Dall.
Dr. 12 fathoms.
nuttingi ..... D. & B
oldroydi ..... D. & B.
tenuicula ..... Gld.
" var. subcuspidata ..... Cpr.
torquata ..... Gld.
Dr. 10 to 20 fathoms.
tridentata ..... Cpr.
Turiccula bairdii ..... Dall.
Dr. 500 fathoms.

Turritella cooperi .. .. Cpr.

Tylondina fungina .... Gabb.

A brilliant orange-colored mollusk, with its horny shell, is found at times at La Jolla.

Venericardia gouldii .... Dall.

Dr. 822 fathoms. Collection of National Museum, Washington, D. C.

ventricosa .... Gld.

Dr. 62 fathoms.

Vermetus centiquadrus .... Val.

Bulletin So. California Academy of Sciences, Vol. IV., No. 8.

Vermicularia fewksii .... Yates.

Dr. 50 fathoms.

Verticordia ornata .... Orb.

Dr. 50 fathoms.

Vitrinella complanata .... Cpr.

subplana .... Cpr.

Dr. 6 to 8 fathoms.

Volvula cylindrica .... Cpr.

Williamia vernalis .... Dall.

Xylotrya pennatifera .... Blain.

setacea .... Tryon.

stutchburyi .... Jeff.

Yoldia cooperi .... Gabb.

Dr. 10 fathoms.

montereyensis .... Dall.

Dredged.

Zirphaea crispata .... Linn.

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NOTE ON THE GENUS HALIOTIS

With a Description of a New Variety

BY HENRY HEMPHILL

The genus Haliotis consists of quite large ear-shaped shells, brilliantly iridescent internally, and when the foreign matter that frequently accumulates on the outer surface is properly removed, most of the shells show a highly-colored exterior.

So far as we know at present the South Seas in the vicinity of Australia, and the adjacent islands, appear to be the metropolis of the genus, for there the greatest number of the known forms are found.

Woodward, Adams and Tryon recognize in their works on Conchology about 75 species.

In the later monograph of this genus by Pilsbry it seems that there have been described and named about 150 species. Dr. Pilsbry recognizes among them about 60 valid species, and 14 varieties worthy of a name, with several that he could not identify by the descriptions alone. The rest he places in the synonomy of the others.

The geographical distribution of the genus may be summed up as follows: Australia and adjacent islands, 30 species; Ceylon, Mauritius and Eastern Seas, 3; West Coast of Africa, 1; Cape of Good Hope, 3; Cape Verde Islands, 1; Mediterranean Sea and British Islands, 1, with two varieties; Gulf Stream, 1; Galapagos Islands (?), 1; Cape Horn Region, 1 and one variety; Philippine Islands, Japan and China, 7 or 8; West Coast of North America, from Alaska south to the Gulf of California, 5 and one variety.

The localities of about 16 species are unknown. None have been found on the west coast of America south of the Gulf of California, and not a single specimen has yet rewarded the researches of the collector along the east coast of America, from the Arctic regions to Cape Horn, except the one species and its variety already credited to the Cape Horn region.

From the above record of its distribution, it will be seen that the genus has succeeded in circumnavigating the globe, though greatly reduced in the number of species as it wanders away from its metropolis or the Australia region.

Since the publication of Pilsbry's monograph of the genus Haliotis. Dr. R. E. C. Stearns has published and described a new variety of Haliotis, which he characterizes and names *Haliotis fulgens*, variety *Walallensis*. This variety was discovered a few years ago on the coast of Mendocino county, California, near Gualala, by Mr. Rivers. Dr. Stearns remarks of this shell as follows:

"This variety differs from the type in its more elongate and flattened form, its constantly finer spiral threading, and its paler nacre. The concentric lamellation is sometimes undeveloped on the young shells. It has the same number of holes as the type.

"The above may be regarded as the extreme northerly expression of *H. fulgens* which has not heretofore been credited to any part of the coast north of Point Conception. From that point to Gualalla is an immense jump, about 320 nautical miles."

While the holes or perforations on the left dorsal side of the shells of the genus Haliotis may be of generic value, or a distinguishing character that serves to separate it from the genus Gena—a smaller but a similar shell without perforations—the number of holes is of no specific value whatever, as will be seen by the following examination of a large number of specimens, both young and adults, of *Haliotis cracherodii* (Leach):

Number of holes, 5 to 9.—Carpenter.

Number of holes, about 8.—Pilsbry.

Dr. Stearns remarks of the number of holes in *H. cracherodii*, as follows:

"Thirty-seven individuals gave a total of 236 complete holes, an average of about 6½. One individual had had only 2, two had 4, while five had 9, approaching the insular form known as *Californiensis* (Swainson). All of the foregoing were adult shells."

An examination of 27 adult shells of *H. cracherodii* (Leach) by myself gave the following result in the number of holes:

Three had 5 holes;
Four had 6 holes;
Seven had 7 holes;
Seven had 8 holes;
Eight had 9 holes;
One had 10 holes.

An examination of 85 young shells of this same species, varying in size from one-fourth of an inch to two inches in length, gave the following variations in the number of perforations:

Two had 3 holes;
Twenty-one had 4 holes;
Forty-four had 5 holes;
Sixteen had 6 holes;
Two had 7 holes.

The smallest individual of the above lot, one-fourth of an inch long, had four holes; the largest, about 2 inches in length, had six holes; but there did not appear to be any regular increase in the number of holes in proportion to the size or age of the shells.

Further examination and close study of these young shells reveals the fact that when the young creature emerges from the egg, the nucleus, or first whorl of its shell, is white in color and without sculpturing or holes. About the time one whorl is added to this embryonic shell the holes and sculpturing appear, and at the same time the little shell, in some instances at least, assumes a dirty brick-red color, but soon changes into the normal shading of brown or blue, while a few shells before me are of a beautiful shade of dark green.

The holes or perforations are arranged in a serial row on the left dorsal side of the shell, and are a little tubular until the shell attains about 2 inches in length. They are generally circular in form, but oblong holes frequently appear with the circular ones in the same individual. The sculpturing consists of a few oblique or curved radiating ridges passing from the nucleus to the holes, over which there passes from eight to twelve wavy spiral threads, a little corded sometimes by the sharp striæ of growth.

The interstices formed by the intersecting ridges and spiral threads often show as deep pits, and especially so in certain shades of light, which gives that part of the little shell near the nucleus a reticulated appearance and adds much to its beauty. With the increase of age and size these sculpture characters change greatly, and even disappear altogether on many of the adult shells. Frequently, however, the spiral threads of the young can be traced on the back of the adults, as low, obscure ribs, wavy or corrugated, and in a few instances the whole back of the shell is covered with obscure corrugations, giving such shells quite a distinct aspect.

Haliotis cracherodii (Leach), var. *californiensis* (Swainson).

The shells of this interesting variety found on Guadalupe Island, Lower California, are peculiar.

The perforations are smaller, more numerous, generally circular, resembling gimlet holes in a piece of wood, closer set together, while the entire row is often higher up on the back of the shell than in the normal or typical shells of *H. cracherodii*.

This combination of characters conspire to give these shells quite a distinct aspect of their own, and notwithstanding that there are numerous intermediates between the extreme forms of these shells and the typical *H. cracherodii*, I think it well for the purposes of study and the illustration of variation to retain Swainson's name, *Californiensis*, for those shells with the small holes without regard to their number on a single

shell, and not jumble together under one name shells so diverse in these characters.

By the kind permission of Miss Cooke, of the World Shell Store, here in San Diego, I have had the privilege of examining the large lot of this variety collected by the late Captain Geo. D. Porter, on Guadalupe Island, Lower California, that are now in her possession.

Three hundred and twenty of these shells show the following variation in the number of holes:

One had 4 holes;
Five had 6 holes;
Twenty-four had 7 holes;
Thirty-two had 8 holes;
Thirty-one had 9 holes;
Sixty-three had 10 holes;
Seventy had 11 holes;
Sixty-five had 12 holes;
Twenty-six had 13 holes;
Two had 14 holes;
One had 15 holes.

Miss Cooke reports finding 12 specimens in this same lot with 16 holes, but these were packed away and not accessible at this time.

The shells average a little smaller and a little thinner than *H. cracherodii*, while the form is more circular, generally. The color of the epidermis varies from a very dark blue, or black, to a yellowish blue and passes through various light and dark shades of brown.

Unfortunately there were none among the lot examined smaller than about three inches long, and these, with adults or larger shells, were well worn in the region of the spire, with the early sculpture characters destroyed.

There is evidence enough, however, on the half-grown and adults among this lot to warrant the assertion that the sculpturing is similar in the young state or on the young shells of this variety, to the typical or normal *H. cracherodii*.

With this knowledge of the variations of the holes and sculpturing of the shells of *H. cracherodii*, we may now briefly consider its mutations in the opposite direction.

Haliotis cracherodii, var. *holzneri* (Hemphill).

I have before me three shells that, while they possess all the characteristics of *Haliotis cracherodii*, they are without perforations, and there is no evidence on these shells that they ever had any holes. Thus they have lost the most important generic character that separates the genus Haliotis from that of the genus Gena, which has smaller but similar shells in every respect except the perforations, which are absent. These

three shells then show the intergrading of these two genera, and are of much importance when taken or considered in connection with the multitude of similar facts already known, and serves to shake our faith in the present methods of classification, specie and genera making. However this may be, these shells are unusually high and arching, as well as narrow and oblong, with the spire much nearer the posterior margin, than any other specimens of *H. cracherodii* that I have examined of the same size.

The spire of all of these shells is well worn, and consequently the sculpturing of the early stages of growth is lost, but there is sufficient evidence on the body of them, similar to that found on the adults of *H. cracherodii* to warrant the assertion that the sculpturing is the same on both forms.

The measurements of these shells are as follows:

Largest specimen—Length 4½, width 3½, height 1¾ inches.

Medium specimen—Length 4¼, width 3⅛, height 1½ inches.

Smallest specimen—Length 4, width 2⅞, height 1½ inches.

Habitat, coast of Lower California.

Mr. Frank Holzner, of San Diego, to whom I dedicate this interesting and very important variety, recently placed these shells in my hands for study and description. They were found in a lot of shells received by him from the lower coast, and he very considerately laid them aside for future consideration. He informs me that he has, at different times, received about a dozen similar shells from the coast of Lower California.

Prof. F. W. Kelsey, of the Commercial College here in San Diego, has already published a note on this variety in *Vol. XVIII, page 67*, of *The Nautilus*, in which he calls it a "freak," and I am indebted to him for one of his excellent photos of the medium-sized specimen. I add a list of all the known forms of our West Coast Haliotis:

Haliotis gigantea, var. *kamtschatkana* (Jonas).

Haliotis rufescens (Swains).

Haliotis corrugata (Gray).

Haliotis corrugata, var. *assimilis* (Dall.).

Haliotis fulgens (Phillippi).

Haliotis fulgens, var. *walallensis* (Stearns).

Haliotis cracherodii (Leach).

Haliotis cracherodii, var. *californiensis* (Swainson).

Haliotis cracherodii, var. *holzneri* (Hemphill).

THE GENUS ENCRINURUS

Its History, Its Species, Its Proper Division in the Family of Trilobites

—BY—

A. W. VOGDES

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Specimens of this Trilobite were known almost 200 years ago; the first to Herrmann, who, in his Maslographia, plate 9, fig. 50, represents a tail of this genus, with six nodes on the axis and nine pleurae; he names it *Pectunculites marmoreus trilobus imbricatus.* This book was published in the year 1711. For copy of original see plate 3, fig. 10.

Some fifty years afterwards Linné, in Act. Reg. Acad. Sci. Holmiens, p. 22, plate 1, fig. 3, gave a figure of a specimen from Gotland, under the general name for all Trilobites, that of *Entomolithus paradoxus.* For copy of original see plate 3, fig. 11.

The author illustrates a tail with 9 pleurae and 20 axial joints; they are notched at the sides: this species served for the type of Wahlenberg's *Entomostracites punctatus.*

Other authors, such as Lehman, Novi Comm. Acad. Sci. Imp., vol. 10, plate 3, fig. 10, and Wilckens, Stralsundishes Mag., vol. 4, 1769, p. 267, plate 3, fig. 12, gave illustration of the pygidium, but without generic or specific description.

Wilckens has the credit of placing the fossil under the Crustacea. He copies Herrmann's figure and names the fossil "*Entomolithum Branchiopodis cancriformis marini.*"

Under the general term of Trilobus, Brunnich Nye Samling, af det Kong. Danskse Vidensk. Skrifker, vol. 1, 1781, p. 394, gave a specific name to the fossil now known as *Encrinurus punctatus.*

The author remarks: "Of the two very imperfect fossils I found in a soft yellowish limestone from Bohemia, I find across the fossil body impressed spotted joints, which are sufficient to distinguish it from other species. The size of it seems to vary greatly, as my limestone contains one small and one very large tail; each has 18 joints."

Wahlenberg, in his Petrificata telluris Svecanae Upsaliae, 1818, p. 32, plate 2, fig. 1*, not fig. 1 (*Calymmene Blumenbachi*), under the general name of *Entomostracites punctatus*, figures a specimen from Gotland.

Brongniart, who was the first author classifying the Trilobites, in his excellent work Hist. Nat. Crust. Foss., 1821, places this fossil under his genus Calymmene, naming it *Calymmene variolaris*, p. 14, plate 1, figs. 3 a-b.

Burmeister Org Trill., p. 114, and other authors, refer Brongniart's plate 1, figure 3a, to *Encrinurus punctatus*, and his fig. 3b to *E. variolaris*. The first is an extended specimen, with the genal angles prolonged into spines; the second a rolled up specimen, in which the genal angles are not extended into spines.

The characteristics of the pygidia are amply sufficient to separate the two common species. *E. variolaris* has 9 axial joints, interrupted in the middle by one or two isolated nodes on each joint, with 7 pleurae, and the axis is not extended into a long caudal spine, as in *E. punctatus*.

The Rev. Dr. Buckland, Geol. & Mineral Bridgw. Treat., vol. 2, 1837, copies Brongniart's figure, plate 1, fig. 3a, on plate 64, fig. 6, under the new name *Asaphus tuberculatus*.

Dalman Palæden, 1826, p. 234, plate 2, fig. 2a-b, gives figures of Gotland specimens No. 6, *Calymmene punctata*, and corrects the error of Wahlenberg's reference to plate 1, fig. 1* (the head of *Calymmene Blumenbachi*, to this species).

Murchison, Syst. Silurian., plate 23, fig. 8, illustrates *E. punctatus*, and on plate 14, fig. 1, an entire specimen of *E. variolaris* erroneously figured with 13 thoracic segments.

Emmrich De, Tril. Dis., 1839, p. 20, describes under the genus *Phacops variolaris* a species with the posterior angles of the head produced into short horns, a common characteristic of the other species, *Encrinurus punctatus*.

As late as the year 1840, the then known two species of this genus were classified under the genera Asaphus, Calymmene and Phacops. Eichwald at this date proposed that of Cryptonymus for the generic name (Sil. Syst. Esthlands, 1840, p. 71). The author placed such specie as *Calymmene punctata* and *C. variolaris*, including in the new genus *C. Woerthi C. parallelus*, now classed under the genus Cybele. The author, in substituting his abandoned name of Cryptonymus (proposed Obser. Geog. Zool. per Ingram. Marique Baltice, 1825, p. 44, there used for eight species, now classed under the genera Asaphus and Illaenus), simply pointed out his generic types without giving a generic description.

This name should stand under the strict rule of priority, for at least such species as *Encrinurus punctatus* or *E. variolaris;* and it was so used by Angelin in his Palaeont. Scand., in which he gave a description of the genus.

Eichwald, Bull. Soc. Imp. Sci. Moscow, 1855, claims priority and gives a history of the generic names.

The same author also remarks, Die Urwelt Russlands, 1840, p. 22: "I found also in Odinsholm fragments of other species, viz: *Calymmene variolaris* Brong. (at that date both *E. punctatus* and *E. variolaris* were classed under the name of *C. variolaris*), which belongs to the genus Cryptonymus. * * * I discovered near Reval an interesting small species of Cryptonymus, which has a tail similar to *Calymmene punctata*, Dalm.

Emmerich, Zur Naturgesch. der Trilobiten, 1844, p. 16, gives the following description of his new genus Encrinurus. The name was taken from the resemblance of the tail to a Crinoid stem., Der schwan and Encrinites:

"Eyes smooth, the glabella inflated and club shaped, the tail with many ringed axis and few pleurae.

"*E. punctatus* Wahl. is so different from all other trilobites that it is entitled to form a separate genus; it unites the clavate glabella of the Asaphus, and has the facial suture and eyes like Calymmene. * * On account of its peculiar shaped pygidium, I have given it the above name."

The author includes *E. punctatus* and two of Portlock's species, *Amphion multi-segmentatus* and *Ogygia rugosa*.

This description, like that of Eichwald, only points out its type. Almost all the authors on Trilobites have used it, with the exception of Angelin, Eichwald and Vogdes.

To retain both genera Emmrich's Encrinurus might be used for *E. punctatus* for a group of species having the genal angles of the head produced into spines, the pygidium, with a many jointed axis, terminating in a long caudal spine or blunt point with 9-10 plurae, such as—

Encrinurus punctatus Brunn, Ordovician and Silurian of Norway, Sweden and England.
——Vigilans Hall .....Silurian of New York.
——Seebachi Schmidt.....Ordovician of Russia.
——Schisticola Tornquist.....Ordovician of Sweden.
——ornatus Hall.....Silurian of New York.
——sex-costata Salt.....Ordovician, North Wales, &c., &c.

And the genus Cryptonymus for Eichwald's second type *E. variolaris* Brong., in which the genal angles of the head are not prolonged into spines. The pygidium has few axial joints and few pleurae. Such as—

Encrinurus variolaris Brong.....Silurian of England.
——expansa Haswell.....Pentland Hills, England.
——obtusus Angelin.....Reg. E Sweden.
——laevis Angelin.....Reg. D Sweden.
——Bowningi Foerste.....Silurian, Australia.
——Indianensis Kindle.....Silurian, Indiana.

Under which we have included the species described under the genus Cromus Barrande.

The Trilobites described under Encrinurus are as follows:

AFRICAN.

Encrinurus cresta-galli Woodward, Quart. Jour. Geol. Soc., vol. 29, p. 32, plate 2, figs. 6 and 7, referred by Lake to Phacops, Devonian.

NORTH AMERICAN.

Encrinurus elegatulus, Billings, Cat. Sil. Foss Anticosti, p. 62. Probably a species of Cybele..... Ordovician.
——vigilans, Hall, Palaeont. N. Y., vol. 1, p. 245, plate 65, fig. 2a-h..... Trenton.
——raricostatus, Walcott, 31st Rep. N. Y. State Mus., p. 69..... Trenton.
——vannulus, Clarke, Geol. Minnesota Palaeont., vol. 3, p. 709.. Trenton.
——cristatus, Clarke, " " " " p. 741.. Trenton.
——tuberculosus, Collie, Bull. Geol. Soc. Amer., vol. 14, p. 218, plate 14, fig. 3; same term used by Buckland for a species of this genus Bridw. Treat., 1837..... Trenton.
—deltoides, Shumard, Geol. Missouri, p. 198, plate B, fig. 10... Silurian.
——Trentonensis, Walcott, 31st Rep. N. Y. State Mus., p. 68... Trenton.
——nereus, Hall, 20th Rep. N. Y. State Mus., p. 375, plate 21, fig. 15..... Niagara.
——Egani, Miller, Cinn. Soc. Nat. Hist., vol. 2, p. 254, plate 15, fig. 1..... Niagara.
——ornatus, Hall, Palaeont N. Y., vol. 2, p. 297, plate 66A, fig. 1a-e..... Clinton.
——Threcheri, Foreste, Bull. Denison Univ., vol. 2, p. 101, plate 8, fig. 26..... Clinton.
——Americanus, Vogdes, Des. new species Clinton group, p. 1... Clinton.
——Indianaensis, Kindle, Geol. Indiana, vol. 28, p. 482, plate 24, figs. 14-15..... Niagara.
——phlyctainodes (Green), Miller, Cat. Amer. Foss, 2nd Ed., p. 574..... Niagara.
This species which Dr. Green, Amer. Jour. Sci., vol. 32, p. 167, compares with *Calymmene variolaris* Brong., Hall refers it to Lichas, Paleont N. Y., vol. 2, p. 314, plate 70, figs. 2a-b, c..... Niagara.

AUSTRALIAN.

Encrinurus Barrandei, DeKonick, Resch. Pal. Foss. Sud. Aust., p. 151, plate 1, fig. 1..... Silurian.
Cromus Murchisoni, DeKonick, Resch. Pal Foss. Sud. Aust, p. 55, plate 1, fig. 9..... Silurian
Encrinurus Bowningi, Foerste, Bull. Denison Univ., vol. 3, p. 122, plate 13, fig. 7..... Silurian.

——Mitchelli, Foerste, Bull. Denison Univ., vol. 3, p. 124, plate plate 13, figs. 2, 3 and 20 .....Silurian.

UPPER ALPS.

Encrinurus Novaki, Fresch. Zeitschr. Deutsch. Geol. Ges., 1888, p. 735, plate 29, figs. 5-9.....Silurian.

BOHEMIA.

Cromus Beaumonti, Barrande, Sil. Syst. Bohéme, vol. 1, p. 826, plate 43. figs. 6-14.

——Bohemicus, Barrande, Sil. Syst. Bohéme, vol. 1, p. 828, plate 43, figs. 15-17.

——transiens, Barrande, Sil. Syst. Bohéme, vol. 1, p. 828, plate 43, figs. 18-19.

——intercostatus, Barrande, Sil. Syst. Bohéme, vol. 1, p. 824, plate 43, figs. 1-5.

Novak Bohm. Ges. Wissensch Jahrg., 1885, refers all of these species to the older genus, Encrinurus.

ENGLISH.

Encrinurus expansa, Haswell, Geol. Pentland Hills, p. 36, plate 4, fig. 4.

——punctatus, Brunn., 1781, Besk. Trilobiten, p. 394, England Wenlock, Dudley, Upper Ludlow, &c., Ordovician of Sweden, Norway, Russia, Silurian of Gotland.

——multi-segmantatus, Portlock, Geol. Londonderry, p. 291, plate 3, fig. 6.....Ordovician of Tyrone, Ireland.

——Stokesi, McCoy, Pal. Sil. Fossils, Ireland, p. 46, plate 4, fig. 15.

——sex-costata, Salter, Mem. Geol. Sur, vol. 2, plate 1, fig. 10 Llandeilo Flags.....North Wales.

——variolaris, Brongniart, Crust. Foss., plate 1, fig. 3b, not 3a, Wenlock Limestone, Dudley, &c.....England.

——fallax, Reed, Quart. Jour. Geol. Soc., vol. 55, p. 751, plate 49, figs. 9, 12 .....Irish Silurian.

RUSSIAN.

Encrinurus Seebachi Schmidt, Ostbal. Sil. Trilobiten, p. 229, plate 14, fig. 16–26 .....Ordovician.

Also E. obtusus Ang., E. punctatus Brunn., E. mulsi-segmentatus, Portl.

SCANDINAVIAN.

Encrinurus, obtusus, Angelin Pal. Scand., p. 3, plate 4, fig. 9, Gotland Reg. E.

——lævis, Angelin, Pal. Scand., p. 4, plate 4, fig. 10, West Gotland Reg. D.

——striatus, Angelin, Pal. Scand., p. 89, plate 41, fig. 13.....Reg. D-E.

——schisticola, Törnquist, Sv. Geol. Under, Ser. C, No. 66, p. 23, plate 1, figs. 15-17.

Also E. punctatus, Silurian of Gotland.

GROUP OF SPECIES WITH 23–33 AXIAL JOINTS IN PYGIDIUM.

Encrinurus punctatus.. .....(Entire) .....23–30 axial joints, 9 pleurae.
——Stockesi, McCoy ... .(Entire).....28 " " 12 "
——Trentonensis, Walc.....(tail).....23 " " 9 "
——Barrandei, DeKon ..... (head & tail) 25–26 " " 9 "
——multi-segmentatus, Portl (tail).....32 " " 9–10 "
——striatus, Ang. .....(tail).....not known " " 10 "
——tuberculosus, Collie.....(tail).....25 " " 8 "
——deltoides, Shum.....(tail).....24 " " 7 "

GROUP OF SPECIES WITH 20 AXIAL JOINTS IN PYGIDIUM.

Encrinurus sexcostatus, Salter (Entire).....20 axial joints, 6 pleurae.
——Americanus, Vogd..... (tail).....20 " " 5–6 "
——ornatus, H. W....(tail, Ohio specimen) ...20 " " 7–8 "

GROUP OF SPECIES WITH 16-18 JOINTS TO PYGIDIUM.

Encrinurus nereus, Hall.....(tail).....18 axial joints, 8–9 pleurae.
——Egani, Miller .....(Entire).....18 " " 6 "
——Threcheri, Foerste.....(tail).....18–20 " " 7–8 "
——raricostatus, Walc..... (tail).....16 " " 6 "
——vannulus, Clarke... ... (Entire 14–16 " " 6 "
——lævis, Ang.....(Entire).....14 " " 8 "
——schisticola, Torng .....(Entire).....14–16 " " 7–8 "
——Bowningi, Foerste.....(Entire).....18 " " 10 "

Encrinurus vigilans, Hall .....(Entire).....18 axial joints, 9 pleurae.

GROUP OF SPECIES WITH 9–15 AXIAL JOINTS IN PYGIDIUM.

Encrinurus variolaris, Brong. (Entire)..... 9–10 axial joints, 7 pleurae.
——expansus, Haswell.....(Entire).....14 " " 8 "
——fallax, Reed... ....(Entire).....12–14 " " 5–6 "
——obtusus, Ang.....(tail).....12 " " 10 "
——Indianensis, Collie ...(head and tail)...15 " " 10 "

The species may be grouped as follows:

ENCRINURUS.

1. Encrinurus punctatus, Stockesi, Trentonensis, Barrandei.
2. E. vigilans, Seebachi.
3. E. sexcostatus, deltoides.
4. E. multi-segmentatus, striatus.
5. E. Nereus, ornatus, Egani, Threcheri, Americanus.
6. E. raricostatus, vannulus.

CRYPTONYMUS.

7. E. variolaris, expansus, obtusus, lævis.
8. Bowningi.

9. E. Indianensis, tuberculosus.
10. E. schisticola.
11. Encrinurus (Cromus) Beaumonti, transiens, Novaki, Murchisoni.
" " intercostatus, Bohemicus.
12. E. Mitchelli, fallax.

ENCRINURUS PUNCTATUS, Brunn.

Syn. Entomolithus paradoxus, Linné, 1759, Act. Reg. Acad. Sc. Holm., p. 22, plate 1, fig. 2, Pygidium, with 9 pleurae, 20 or more axial joints.
Trilobus punctatus, Brunn., Kjobenh. Sellsk. Skrivt. nye Samml., vol. 1, p. 394; no illustration.
Entomostracites punctatus, Wahlenb., Petrif. telluris Svecanae., p. 32, plate 2, fig. 1, not fig. 1*.
Calymmene variolaris, Brong., Crust Foss., plate 1, fig. 3a, not fig. 3b, which represents E. variolaris.
——punctatus, Dalman, Palaeaden, p. 234, plate 2, figs. 2, a, b.
————Murch., Sil. Syst., p. 661, plate 23, fig. 8a-b.
Phacops variolaris, Emmrich, Diss., p. 20.
Asaphus, tuberculatus, Buck., Bridgw. Tr., plate 46, fig. 6.
Encrinurus punctatus, Emmrich, Neus Jahrb., p. 42.
——Stockesii, McCoy, Syn. Sil. Foss. Ireland, p. 46, plate 44, fig. 15.
——punctatus, Corda, Prodr. Tril., p. 91, fig. 55.
Cybele punctatus, Fletcher, Quart. Jour. Geol. Soc., vol. 6, p. 403, plate 32, figs. 1–5.
Encrinurus punctatus, Salter, Mem. Geol. Sur. Dec. 7, plate 4, figs. 15–16.
Kuotr., Verh. Min. Ges. zu St. Pet., 1847, p. 299, plate 8, fig. 4a, b, c, e. f, g.
——Hoffman, Verh. Min. Ges. St. Pet., 1857–58, p. 35, plate 3, fig. 3a-e.
——Nieszkowski, Archiv. Nat. Liv. Ehst Kurl, p. 4, plate 3, figs. 6–7.
——Baily, Fig. Char. Brit. Foss, p. 67, plate 23, fig. 2.
——Steinhardt, Preuss. Tril., p. 57, plate 4, fig. 15.
——var calcareus, Salt., Nicholson & Etheridge Sil. Foss. Girvan Dist., p. 108 and 205, plate 10, fig. 7.
——punctatus, Etheridge, Jour. Roy. Soc. N. S. Wales, vol. 14, p. 3, plate 1, figs. 11 and 12.
——Schmidt, Ostb. Sil. Tril., p. 225, plate 14, figs. 11–13; plate 15, fig. 18.
——Roemer, Lethæa Palaeoz, plate 17, fig. 8.
Novak, Bohm., Ges. Wissensch Jahrg., 1885, p. 5, plate 1, figs. 1–8.
——Roemer, Lethæa erratica, 1885, plate 7, fig. 21.
——Foerste, Bull. Denison Univ., vol. 2, p. 102.
————Proc., Boston Soc. Nat. Hist., vol. 24, p. 269, for E. ornatus, H. & W., E. Threcheri Foerste.
——Wigan, Zeitschr., Deutsch Geol. Ges. 1888, p. 91, plate 10, fig. 23.
——Foerste, Geol. Ohio, vol. 7, p. 531.
——Trentonensis, Walc., 31st Rep. N. Y. State Mus., p. 68.
——punctatus, Vogdes, Mong. genera Zethus, &c., p. 18, plate 1, figs. 1–5 and 17; plate 2, figs. 5–8; plate 3, figs. 15 and 16.

ENCRINURUS, Emmrich, 1844.

Diagnosis: The cephalic shield is semi-lunar, with the genal angles produced into long spines.

Glabella clavate; surface of the glabella and cheeks tuberculated.

Obscure glabella furrows.

Thorax with 11 segments; pleurae not grooved; tips notched.

Pygidium triangular; axis of many joints, 18-23-30; centre marked by a single row of nodes and terminating in a long caudal spine.

Pleurae, 8-10-12.

ENCRINURUS PUNCTATUS, Brunn. Plate I, figs. 1–18; Plate II, figs. 23–24.

Range, Ordovician of England, Sweden, Norway and Russia, &c.

Silurian of Gotland, Sweden.

Description: The general form ovate, nearly twice as long as wide. The head is bounded by a thick marginal border, which is narrow at the glabella and ornamented with two rows of tubercles.

Glabella clavate and gibbous, overhanging with 3 indistinct lateral furrows; large frontal lobe.

The facial sutures commence on the exterior margin of the head, just above the genal angles, and run in an oblique direction to the large pedunculated eyes, over their base, near the middle of the cheeks, then converge to the front of the glabella; they then turn suddenly, at an angle of 90 degrees, downward, and running parallel in a vertical direction to the marginal edge, which they cut, and converging, combine into a rostal suture.

The fixed cheeks are triangular, and separated in front by the vertical suture, convex and tumid.

Free cheeks are prolonged at their genal angles into spines.

The occipital furrow is continuous; occipital ring broadest in the centre, which is smooth, but has a node at each extremity.

Hypostoma ovate, obscurely granulated, surrounded by a sinuated margin, connected by its pointed end with the head. The wings are short and triangularly pointed. A furrow runs from each side up to one-third part of its length, which runs vertical, and its end not visible in the posterior thickened part, a small, obtuse continuation is seen.

Thorax with 11 segments. Pleurae without grooves, notched at their ends, but not spined; surface tuberculated. The axial joints are somewhat narrower than the pleurae. Spines occur on the 7, 9, and 10 axis joints.

Pygidium triangular, terminating in a caudal spine, the axis tapering posteriorly to an acute end, which has from 23–30 distinct side notches; the centre is smooth, with 7 prominent nodes: between the 1–3 nodes 2 notches appear; the 3–4 nodes have 4 notches; 4–5 nodes, 5 notches; 6–7 nodes, 5 or 6 notches appear.

The numerical arrangement of these nodes is not inviolable.

Pleurae 8, with a central row of tubercles.

Some Ludlow specimens have the glabella narrower, and but 4 nodes down the axis of the tail. (Salter.)

The variety called *arenaceus* Salt. differs only in the abrupt ending of the tail, which has not the long caudal spine of *E. punctatus*, but the terminal joint of the axis of the tail is deflected and blunt.

ENCRINURUS VIGILANS, Hall. Plate III, figs. 17, a, g. From Trenton Limestone of New York.

The head is more than semi-lunar in form, with its genal angles produced into long spines extending to the tail. The glabella is not lobed The front lobe is thickened and marked with 2 rows of tubercles. Eyes facetted, prominent.

Thorax with 11 segments; the axis has on every second joint a node or short spine.

Pygidium triangular, with 9 pleurae, every alternate one being ornamented with a node. Axis of 18 joints, every third one being marked by a node.

The specimen has only 18 axial joints in the tail, and a longer spine to the genal angles of the head, than the type E. punctatus, and should be compared with *E. Seebachi*, Schmidt.

ENCRINURUS ORNATUS, Hall & Whitfield. Plate III, figs. 15, 15a.

The authors refer *Cybele punctatus*, Hall, Pal. N. Y., vol. 2, p. 297, plate 66a, figs. 1a-e, to this species. Pal. Ohio, vol. 2, p. 154.

The Clinton specimens from New York have a subcresiform head, with the genal angles produced into spines extending to the fourth thoracic segment. Glabella clavate, also tuberculated; plate 66a, fig. 1, shows two lateral furrows. Thorax with 11 segments.

Pygidium triangular; no caudal spine shown in illustrations. Axis of 20 or more joints, notched at the sides, centre with row of 6 nodes, located on the 1st, 4th, 8th, 13th, 17th, 20th axis joints.

Other specimens from Clinton, at Lockport, have 7–8 pleurae, with 5 nodes on the axis of the tail, viz: on the 7th, 11th, 15th, 19th and 23d joints. These nodes occur at variable intervals, but with sufficient irregularity to discredit the value of such features for specific distinctions.

Pleurae 7–8, marked with a central row of 3 or more tubercles.

The Ohio species, *E. ornatus*, is of larger size; it has 20 axial joints, 7 pleurae in the tail, with 5 nodes on the 2nd and 5th joints, the three others having three segments between each node.

ENCRINURUS THRECHERI, Foerste.

In the Proc. Boston Soc. Nat. Hist., vol. 24, p. 269, the author places this species with Hall's E. ornatus under E. punctatus.

The species has 13–18 axial joints and 7 pleurae in the pygidium, with nodes on the 5th, 8th, 11th, 12th, 15th and 18th joints.

ENCRINURUS TRENTONENSIS, Walcott. Syn. *E. punctatus.*

This species from the Trenton Group of Wisconsin was described from the pygidium; it has 23 axial joints, with nodes on the 3rd, 6th, 10th, 14th, 18th and 22nd, with 9 pleurae.

ENCRINURUS NEREUS, Hall. From Niagara Group, Racine, Wis.

This species, described from a tail, has 18 axial joints and 8–9 pleurae. The rings of the axis are distinct and not notched at the sides.

ENCRINURUS EGANI, Miller. From Niagara Group at Joliet, Illinois. Plate III, fig. 13.

The genal anges are spined; glabella clavate and gibbous; projects in front beyond the narrow rim. Thorax 11; segments grooved.

Pygidium a little wider than long, with caudal spine.

Axial joints 18, with centre row of 4 nodes on the 4th, 7th, 11th and 14th joints. Pleurae, 6.

This group of species from the Clinton Group, consisting of *E. ornatus and Threcheri with Egani*, and *Nereus* from the Niagara Group, vary slightly in the number of axial joints, 18 to 20; and in the pleurae from 6 to 9: all of these species probably belong to the same species, and should take the older name, that of *E. nereus*, Hall.

Encrinurus Americanus, Vogdes, from the Clinton Group of Georgia, which has 20 axial joints and 5 or 6 pleurae, belongs to the same group.

ENCRINURUS SEX-COSTATA, Salter. Plate II, figs. 1–12.

Cybele sex-costata, Salter, Mem. Geol. Sur., vol. 2, pt. 1, plate 8, fig. 10, not fig. 9, 1848.

Zethus sex-costata, McCoy, Synops. Pal. Foss. Woodw. Mus., fasc. 1, p. 156.

Encrinurus sex-costata, Salter, Mem. Geol. Sur., Decade 7, plate 4, figs. 1–11.

——Brit. Pal., Rocks & Foss, Appendix A, 1855, p. iv, plate 1G, figs. 6–7.

—Nieszkowski, Archr. Nat. Liv. Ehst. Kurl, 1857, p. 80.

——Vogdes, Mong. genera Zethus, &c., p. 25, plate 3, figs. 1–12.

General shape, broad ovate head, and tail convex; body rather flat; head triangular; genal angles produced; the front rounded, gibbous and overhanging. Glabella pyriform; it overhangs the margin; there is a strong furrow which runs across the front of the glabella, separated from it by a thick, prominent ridge (fig. 3a); it has three short lateral furrows.

The cheeks, though convex, are much less so than the glabella, and bear the eyes in the middle, the surface pitted with fine granules. The free cheeks have their outer margin thick and separated by a furrow, with the genal angles produced into spines.

The posterior margin has a strong neck furrow continued along it. Thorax with 11 segments; each pleurae is nearly semi-cylindrical, with a row of 3–4 tubercules along its centre; tips bilobed.

Pygidium triangular, wider by one-third than the length, with obtuse rounded anterior margin. Axis with 20 joints extending across it, but

the upper one-third becomes flatter, and the rings are effaced along the middle. No nodes along the smooth central portion.

Pleurae 6, strongly indicated, divided from each other by narrow, deep furrows; ends squarish and obtuse. The upper four pleurae are free, but the two others are fused with those from the opposite side and extend in a very blunt point beyond the tip of the axis.

Llandeilo Flags, North Wales.

ENCRINURUS DELTOIDES, Shumard, Geol. Missouri, p. 198, Plate B, fig. 10.
Cryptonymus deltoides, Vogdes, Mong. genera Zethus, &c., p. 21.
Encrinurus deltoides, Foerste, Bull. Denison Univ., vol. 2, p. 102.
———Keyes, Geol. Missouri, vol. 4, Palaeont, p. 229.

The description of this species was drawn from a pygidium, Silurian of Cape Gardeau, Mo.

Pygidium subtriangular; width greater than the length. Axis flattened, convex, with 24 axial joints; the first 4 or 5 are entire, the others are interrupted in the middle of the axis and bear several very small granules. Pleurae, 8.

This species is related to E. sex-costata, Salter, from which it differs in the greater number of pleurae and axial rings.

ENCRINURUS BARRANDEI, DeKonick, Resch. Pal. Foss. Sud Aust, p. 51, Plate I, fig. 8.

——Trans. Mem. Geol. Sur. N. S. Wales, Palaeont, No. 6, p. 40, plate 1, fig. 8.

Head and tail only known from Yarralumla.

The head is similar to *E. punctatus;* it is, however, a little broader; the glabella less convex. The occipital furrow faintly marked; genal angles are rounded.

Pygidium subtriangular, slightly broader than long. The axis has 25–26 joints, not tuberculated. Pleurae 9, smooth; no caudal spine.

ENCRINURUS MITCHELLI, Foerste, Bull. Denison Univ., vol. 3, p. 124, Plate XV, figs. 2, 3 and 20.

The author illustrates the glabella fixed, and free cheeks, thorax and tail. The thorax has 12 segments. Pygidium 9–10; pleurae smooth, and 28 axial joints, notched at the sides, with a central row of nodes. No caudal spine indicated. Silurian of Australia.

ENCRINURUS SCHISTICOLA, Tornquist, Sv. Geol. Under. Ser. C, No. 66, p. 23, Plate I, figs. 15–17.

The author illustrates the glabella, part of the thorax and tail.

The head has the genal angles produced into short spines. The pygidium triangular, with a caudal spine. Axis 14–16 joints, extending across it, with a central row of nodes. Pleurae, 7–8; first 5 obtusely rounded, the last 2 spinous. Surface granulated.

Dist. of Siljan Dalecarlia.

ENCRINURUS SEEBACHI, Schmidt, Obsbal. Sil. Tril., p. 229, Plate XIV, figs. 16–26; Plate XV, figs. 21–23.

The author illustrates the entire species in parts from Wesenberger.

The genal angles of the head are produced into long spines, almost to the last segment of the thorax, as in *E. vigilans*, Hall. The glabella and cheeks coarsely granulated.

Thorax with 11 segments. The axis has a spine on the 7th, 9th, 10th and 11th joints.

Pygidium triangular in shape. Axis 30–32, axial joints extending across it. No nodes. Pleurae 9; not tuberculated.

Hypostoma the same as that of E. punctatus.

ENCRINURUS MULTI-SEGMENTATUS, Portlock.

Amphion multi-segmentatus, Port., Geol. Rep. of Londonderry, p. 291, plate 3, fig. 6 a-b.
Ampyx? baccatus, Port., Geol. Rep. of Londonderry, p. 262, plate 3, fig. 11.
Encrinurus multi-segmentatus, Salt., Mem. Geol. Sur., Dec. 7, Encrinurus, p. 7.
————Nieszk., Mong. Tril. Ostseeprov., p. 609 (ex. pt.)
————Schmidt, Untersuch Sil. Form. Erkl., p. 190 (ex. pt.)
————Roemer, Foss. Fauna V. Sandewitz, p. 75, plate 8, figs. 7, a, b, c.
Cryptonymus multi-segmentatus, Vogdes, Mong. genera Zethus, p. 29.
Encrinurus multi-segmentatus, Schmidt, Ostbal. Sil. Tril, p. 227, plate 14, figs. 14–15; plate 15, figs. 19–20.
——Tornq., Sv. Geol. Under., Ser. C, No. 66, p. 24, plate 1, figs. 18–19.
——Roemer, Lethaea erratica, plate 4, figs. 14, a.

The author figures the pygidium (plate 3, figs. 6-a, b) and the head as *Ampyx baccatus*, plate 3, fig. 11.

The following is the original description:

Characters: "Axial segments very narrow and numerous, 28 being enumerated as far as the last side segment, and still continuing through very minute, to the very apex. A small, lozenge-shaped caudal plate. Side segments, 12 on each side, exclusive of the false segment. They are rounded and slightly bent or raised at their extremities; no punctures or marks of any kind."

Dr. Roemer Foss., Fauna von Sadewitz, p. 75, plate 8, figs. 7, a, b, c, illustrates a head and tail, which he refers to this species; fig. 7-a of the head has the genal angles prolonged into short spines; fig. 7-c of the tail, exhibits side notches on the axis and a smooth centre; no ornamentations

The same author referred *Encrinurus striatus*, Ang., to this species as a synonym.

The Irish species will easily be distinguished by its large, coarsely tuberculated head and many ribbed tail. The crest of large tubercles on the glabella are parted in the middle along the front of the glabella.

ENCRINURUS FALLAX, Reed, Quart. Jour. Geol. Soc, vol. 50, 1899, p. 753, Plate XLIX, figs. 9–12.

The author illustrates an entire specimen of a young individual; also the head and tail of an adult; from County Waterford, Ireland.

The head shield broadly semi-circular, strongly convex. Glabella convex, subcylindrical, slightly broader in front than at the base; not inflated in front or overhanging the margin. Three pair of short lateral furrows. Frontal lobe twice the length of the anterior pair of lobes; not overhanging them laterally; it is rounded in front, where it is encircled by a marginal furrow, which runs into the deep and strong axial furrow. A narrow tuberculated, almost horizontal border, is thus marked off from the anterior end of the glabella, as in E. Seebachi, Schm. Fixed cheeks, convex; elevated genal angles, bent down. Eye lobe large and elevated.

The facial suture curves backwards and outwards from the front of the glabella to the 2nd lateral furrow, where the eye is situated; from this point it bends slightly outwards, and running nearly parallel to the posterior margin in front of the genal angles. Surface ornamented with small tubercles.

Thorax with 12 segments. Axis convex; each ring has a median, raised, rounded ridge, ornamented with tubercles; narrow, flat, articulating band on the anterior and posterior margins. A conspicuous nodule is seen on each side of the axis, as in *Calymmene Blumenbachi*. Pleurae with medium tuberculated ridge; free ends bluntly pointed. Pygidium with 12–15 axial joints; only the first 9 or 10 rings are entirely across the axis; sometimes only the first four. The axis ends in a bluntly pointed extremity. The anterior joints have each four tubercles The 1st pleurae, 3 tubercles; 2nd, two or three; 3rd, two, and the 4th and 5th, one or two each. The first pleurae are strong, without furrows, and curve regularly backwards; the 5th and 6th pair are weaker, and run nearly straight backwards.

The author compares the species with *E. sex-costatus*, Salt. It has not the overhanging glabella of that species; the lateral furrows of the glabella are different; cheeks are tuberculated, not pitted; number of axial joints in the pygidium is less; pleurae curve back more strongly, and ornamented with tubercles. Salter's species has smooth pleurae.

Remarks.—The facial sutures, the glabella, 12 thoracic segments, ridged pleurae, also the pygidium, all point to Cybele or a prototype of that genus.

A similar species from Australia, described as *E. Mitchelli*, by Foerste, has the ridged pleurae and 12 thoracic segments; also the conspicuous nodules on each side of the axis of the thorax, with a similar tail, but it has a greater number of axial joints (28) and pleurae (9–10). The cast now before me from Bowning does not indicate tubercles.

CRYPTONYMUS, Eichwald, 1840.

Diagnosis: Head semi-circular; genal angles rounded, not produced into spines, as in E. punctatus. Glabella gibbous and overhanging, with obscure furrows. Eyes prominent; smooth. Thorax with 11 segments. Pleurae without grooves, notched at ends. Pygidium triangular, convex, and rounded at the end, with 9–15 joints and few pleurae (7 or more).

In typical *Encrinurus punctatus*, &c., the axial joints of the tail have a single row of nodes; in *Cryptonymus variolaris*, &c., the axial joints two or more rows.

CRYPTONYMUS VARIOLARIS, Brong., Plate III, figs. 8–9.

Not named Parkinson Org. Rem., vol. 3, plate 17, fig. 16.

Illustrates a head and part of thorax, inflated glabella, with large tubercles.

Calymmene variolaris, Brong., Crust. Foss., p. 14, plate 1, fig. 3-b, not 3-a.
——Murch., Sil. Syst., p. 655, plate 14, fig. 1 (entire).
Cybele variolaris, Salter, Mem. Geol. Sur., vol. 3, plate 1, p. 344.
—— Fletcher, Quart. Jour. Geol. Soc., vol. 6, p. 403, plate 32, figs. 1–5.
Zethus variolaris, McCoy, Pal. Foss. Woodw. Mus., p. 157.
Encrinurus variolaris, Salter, Mem. Geol. Sur., Dec. 7; Encrinurus, p. 7, plate 4, figs. 13 and 14.
Cryptonymus variolaris, Vogdes, Mong. genera Zethus, &c., p. 21, plate 1, figs. 6–10; plate 3, figs. 13–14.

Description: Head triangular, gibbous, one-half as long as wide, tuberculated. Glabella gibbous and overhanging, spherical, with a short neck; the inflated glabella has not an anterior row of tubercles, as in E. punctatus.

Glabella furrows obscured by the size of the tubercles. Eyes large, smooth. Occipital ring smooth. Genal angles rounded, with prominent tubercle in place of spine. Thorax with 11 segments. Pleurae without furrows and notched at ends. Pygidium with 9–12 axial joints; each joint frequently interrupted in the middle by one or two isolated nodes. Axial grooves distinct; not notched at their sides, as in *E. punctatus*. Pleurae 7, bent down; not spinous, but prominent at the ends; no terminal caudal spine.

English species, Wenlock Limestone, &c., known as the Strawberry-headed Trilobite.

CRYPTONYMUS EXPANSA, Haswell, Sil. For. Pentland Hills, p. 36, plate 4, fig. 1.

Glabella pear-shaped, rounded in front, narrow behind, with 2 glabella furrows extending on each side one-fourth its width, studded with about 28 small tubercles. Fixed cheeks, convex; triangular genal angles rounded; eyes lateral, projecting; thorax with 11 segments. Pygidium

bent down; axis smooth in the centre, with transverse marking at the sides; 14 joints; 8 pleurae.

This is a doubtful species of Cryptonymus, but placed here on account of its characteristic tail.

CRYPTONYMUS OBTUSUS, Ang., Pal. Scand., p. 3, plate 4, fig. 9.

Cryptonymus obtusus, Vogd., Mong. genera Zethus, p. 22.

Encrinurus obtusus, Pompecki, Tril., Fauna Westpreuss, p. 39, plate 5, figs. 25, 25-a.

——Wigand, Zeitschr. Deutsch. Geol. Ges. 1888, p. 92, plate 10, fig. 24.

This species was described from a tail and part of the thorax from Reg. E, Gotland.

The pygidium is triangular; axis with 12 joints, notched at the sides, with a row of central nodes; pleurae 10.

Pompecki, plate 5, figs. 25 and 25-a, show 14 joints, with 10 pleurae. The anterior border of the hypostoma is very much produced in the species (see Limdstrom Visual Org. Tril., plate 4, fig. 15.) Plate 3, fig. 14.

ENCRINURUS RARICOSTATUS, Walcott, Adv. sheets 31st Rep. N. Y. State Mus., p. 16, 1877; p. 69 of the report, 1879.

Encrinurus raricostatus, Safford & Vogdes, Proc. Acad. Nat. Sci., Phila., 1887, p. 167, fig. in text.

Cryptonymus raricostatus, Vogdes, Mon. genera Zethus, &c., p. 27.

Encrinurus raricostatus, Clarke, Geol. Minnesota, vol. 3, p. 740.

Pygidium subtriangular, convex; length and breadth about equal. Axial not very prominent, with 16 joints. Pleurae 6.

A similar species from the Trenton Limestone of Wisconsin was described by Clarke, Geol. Minnesota, vol. 3, p. 739, as *Encrin. vannulus*. The author illustrated the head, thorax in part, and pygidium. The axis of the tail has 14 or 16 joints, with the first 6 or 7 joints extending across it; the others are notched at the sides. Pleurae 6.

CRYPTONYMUS LAEVIS, Angelin, Pal. Scand. p. 4, Plate IV, fig. 10, Reg' E. Gotland.

——Vogdes, Mong. genera Zethus, &c., p. 22, plate 2, fig. 10.

——Wigand, Zeitschr. Deutsch. Geol. Ges., 1888, p. 92, plate 10, fig. 25.

The author figures an entire specimen. The genal angles of the head are rounded, and the surface coarsely tuberculated. Thorax, 11 segments. Pygidium triangular, with 7 smooth pleurae; axial joints 14, notched at the sides; centre smooth.

The hypostoma has its anterior margin prolonged, which characteristic marks the species. (Lindstrom Visual Org. Tril., plate 4, fig. 16). See plate 3, fig. 16.

ENCRINURUS BOWNINGI, Foerste, Bull. Denison Univ., vol. 3, plate 22.

The author illustrates the glabella only, which he compares with E. Barrandei, DeKon.

The glabella is inflated, clavate, covered with large tubercles. In a specimen from Bowning, N. S. Wales, now before me, the thorax has 11 segments; it does not show the ends of the pleurae. Pygidium one-third wider than long; it has 10 pleurae. The axial joint, 18 or more; the first 10 are entire and extend across the axis to opposite the 8th pleurae; the other notched at the sides; the centre is smooth and ornamented by 4 nodes on the 2nd, 3rd, 6th and 9th joints.

ENCRINURUS TUBERCULATUS, Collie, Bull. Geol. Soc. Amer., vol. 14, p. 418, Plate LIX, fig. 3, Oct. 19, 1903.

This name used by Buckland for a species, Bridgw. Treatise, 1837, for the species now known as *E. punctatus*.

Encrinurus Indianensis, Kindle, Geol. Indiana, vol. 28, p. 482, plate 24, figs. 14–15, 1904.

The Indiana specimen exhibits the glabella, fixed cheeks and tail; the genal angles apparently terminating in short spines; the pygidium elongate-triangular, convex, with 15 axial joints extending across it, each joint ornamented by 3 to 5 nodes. Pleurae 10 (fig. 15, plate 24, only shows 8 or 9.)

The Pennsylvania specimen has 25 axial joints, with 3 nodes on each joint; 8 pleurae.

The number of axial joints and pleurae vary so much in species of this genus, that this slight variation discredits the value of such features for specific identification.

Remarks on the genus Cromus Barrande :

Certain species, which Barrande has placed under his genus Cromus Novak (Ges Wissensch Jahrg, 1886) has referred the older genus Encrinurus, on account of the direction of their facial sutures, which are the same in both genera. They are :

CROMUS BEAUMONTI, Barr. Sil. Syst. Bohéme, p. 826, Plate XLIII, figs. 6–14.

In which the genal angles of the head are rounded off; the glabella 4-lobed; pygidium 15–20; axial joints with 1–4 tubercles on each ring; pleurae 12 tips, rounded. See plate 2, figs. 13–15.

CROMUS BOHEMICUS, Barr, Sil. Syst. Bohéme, p. 828, Plate XLIII, figs. 15–17.

In which the genal angles of the head are rounded off; pygidium 20; axial joints 12; pleurae ends ending in spines. See plate 2, figs. 20–21.

CROMUS TRANSIENS, Barr, Sil. Syst. Bohéme, p. 828, Plate XLIII, figs. 18–19.

In which the tail is triangular; pleurae 10–12; ends rounded off; axis 12–14; from 2–5 tubercles on each ring. See plate 2, figs. 16–19.

Cromus intercostatus, Barr, Sil. Syst. Bohéme, p. 824, Plate XLIII, figs. 1–5.

In which the head and tail is spined with 20–28 axial joints; pleurae 12–16; all from Reg. E. See plate 2, fig. 22.

All the species are characteristic of the typical Cryptonymus in having their genal angles of the head rounded off; pygidia with few joints, 12–20; and few pleurae, 10–12–16, without the long caudal spine common to those species which we have classed under Encrinurus. The replacement of fine granules, in place of coarse tubercles, gives a better view of the marking of the glabella, and exhibit 4 lobes on each side.

The pygidia of *C. Beaumonti* and *C. transiens* are those of Cryptonymus, although the head of *C. intercostatus* has the genal angles spined. It exhibits only the variation common to all the genera.

The pygidia of *C. intercostatus* and *Bohemicus* have the ends of the pleurae spinous with the Encrinuridæ; they are notched at the end. There is a general tendency of all Trilobites with semi-cylindrical pleurae, to extend themselves into spinous terminations, and should only have specific value.

Törnquist exhibits a species, *E. schisticola*, from Dalecarlia, which has the terminal pleurae of the tail spinous. We also note that the tubercles on the axis of the tail vary in number from 1–5; in the centre the tendency is to become enlarged. This characteristic is more in keeping with species of Cryptonymus than in Encrinurus, which has only the central row of nodes.

In tracing these spinous forms from the Ordovician to the Silurian, we notice that each group begins its history in notched segmentation. This form of pleurae develops into spinous form; becomes more abundant at the culminating of the group, reached in Cromus intercostatus; afterwards the genus becomes extinct in the higher Silurian beds.

Encrinurus Novaki, Frech, Zeitschr d. Deutsch Geol. Ges., 1887, p. 735, Plate XXIX, figs. 5–9 of Cromus Beaumonti.

Cromus Murchisoni, DeKoninck Rech. Foss. Pal. Sud. Aust., p. 55, Plate I, fig. 9.

The species is distinguished from all others by the shape of the glabella and depth of the furrows which separate it from the fixed cheeks.

Explanation of Plate I.

Encrinurus punctatus.

Fig. 1. The head enlarged.

Fig. 2. The head and part of the thorax enlarged.

Fig. 3. The pygidium enlarged.

Fig. 4. Side view of the pygidium enlarged.

Fig. 5. Interior view of the pygidium enlarged.

Photographic copies of Kutorga's plate 8, figs. 4 a-f, with an alteration of the anterior course; facial sutures.

Fig. 6. Full grown specimen.

Fig. 7. Adult specimen.

Fig. 8. The pygidium, upper fig. of the 10th segment, with spine.

Fig. 9. Under side of head, showing hypostoma; lower fig.; eye magnified.

Fig. 10. The hypostoma; the tip is slightly recurved.

Photographic copies of Fletcher's plate 32.

Fig. 11. The hypostoma, after Lindstrom's plate 4, fig. 5.

Fig. 12. The hypostoma, front and side view—after Lindstrom's plate 4, figs. 12 and 13.

Fig. 13. The hypostoma enlarged, a sinuated margin: b, cucullate base; c, the points of the extended base of attachment.

Photographic copies of Salter's plate 4.

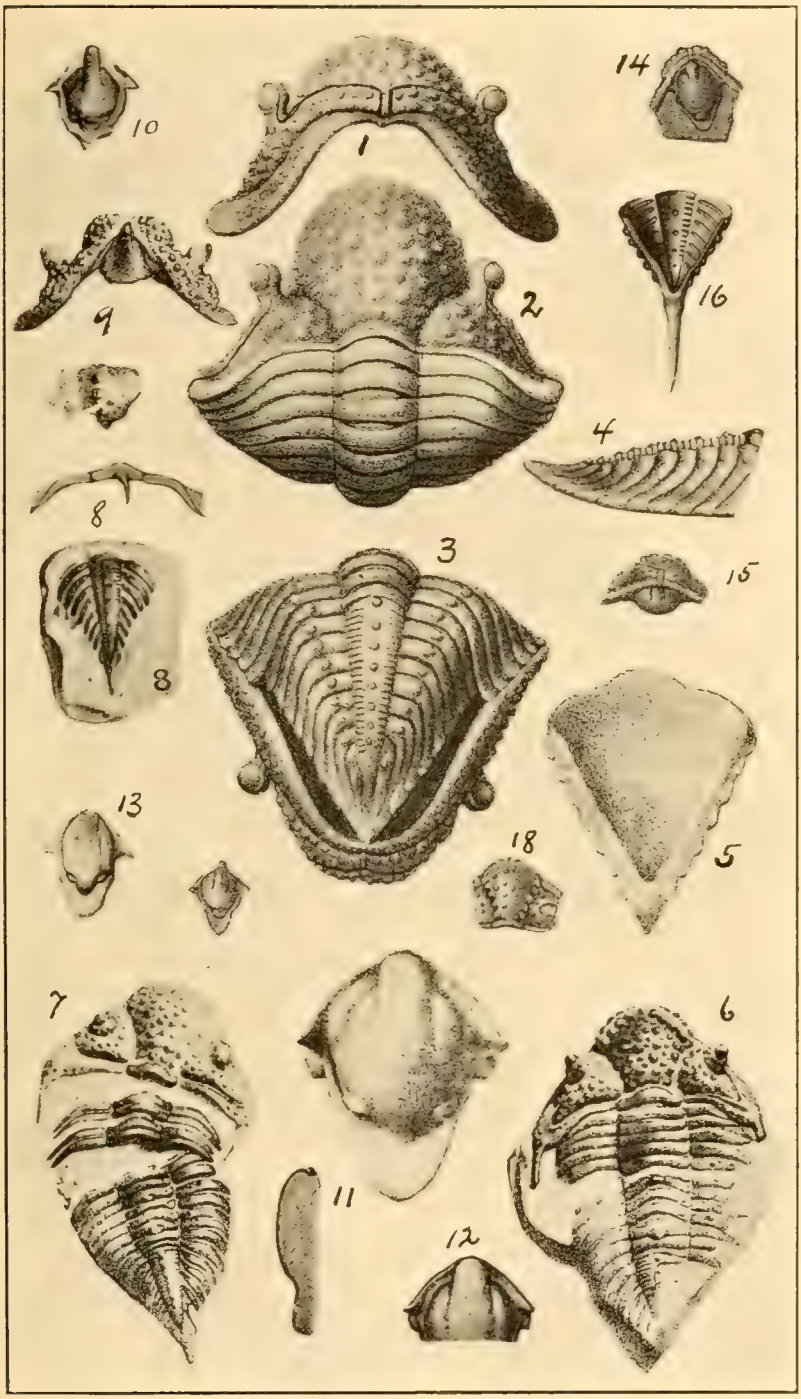
Fig. 14. The head, showing anterior course of facial sutures and hypostom—aafter Schmidt's figures.

Fig. 15. Front view of the head.

Fig. 16. Under view of the tail, somewhat enlarged to show the incurved scabrous margin which unites the lateral ribs of the tail; their free points are seen projecting beyond it—after Salter's plate 4, fig. 15.

Fig. 17. The hypostoma.

Fig. 18. The glabella and fixed cheek; shows anterior course of facial suture.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Explanation of Plate II.

Encrinurus sex-costatus, Salter.

Fig. 1. A rolled up specimen; from Rhiwlas.

Fig. 2. A view showing the 11 thoracic segments.

Fig. 3. Anterior view of the head and tail, showing the raised ridge of the anterior branches of the facial suture.

Fig. 4. Side view.

Fig. 5. Head cheeks and glabella, showing pitted surface.

Fig. 6. Magnified view of glabella, showing tuberculated and granulated surface of glabella, with 3 lateral glabella furrows.

Fig. 7. A thoracic segment enlarged: at a, the fulcral point; b, the facetted, and c, the blunt, indented tip of the segment.

Fig. 8. Side view of the pleurae in a coiled state; at a, one of the facetted surfaces is seen.

Fig. 9. The pygidium.

Fig. 10. Part of the same magnified, to show the scabrous surface.

Fig. 11. Variety of the pygidium, with 7 pleurae; also fig. 12.

Photographic copies of Salter's plate 4, figs. 1–12.

Fig. 13. Encrinurus (Cromus) Beaumonti, Barr. The head.

Fig. 13-a. The under side of the head.

Fig. 14. Side view of the head.

Fig. 15. Anterior view, showing course of facial sutures.

Fig. 16. Encrinurus (Cromus) transiens, Barr. Glabella and fixed cheeks.

Fig. 17. Side view.

Fig. 18. The hypostoma.

Fig. 19. Front view of the hypostoma.

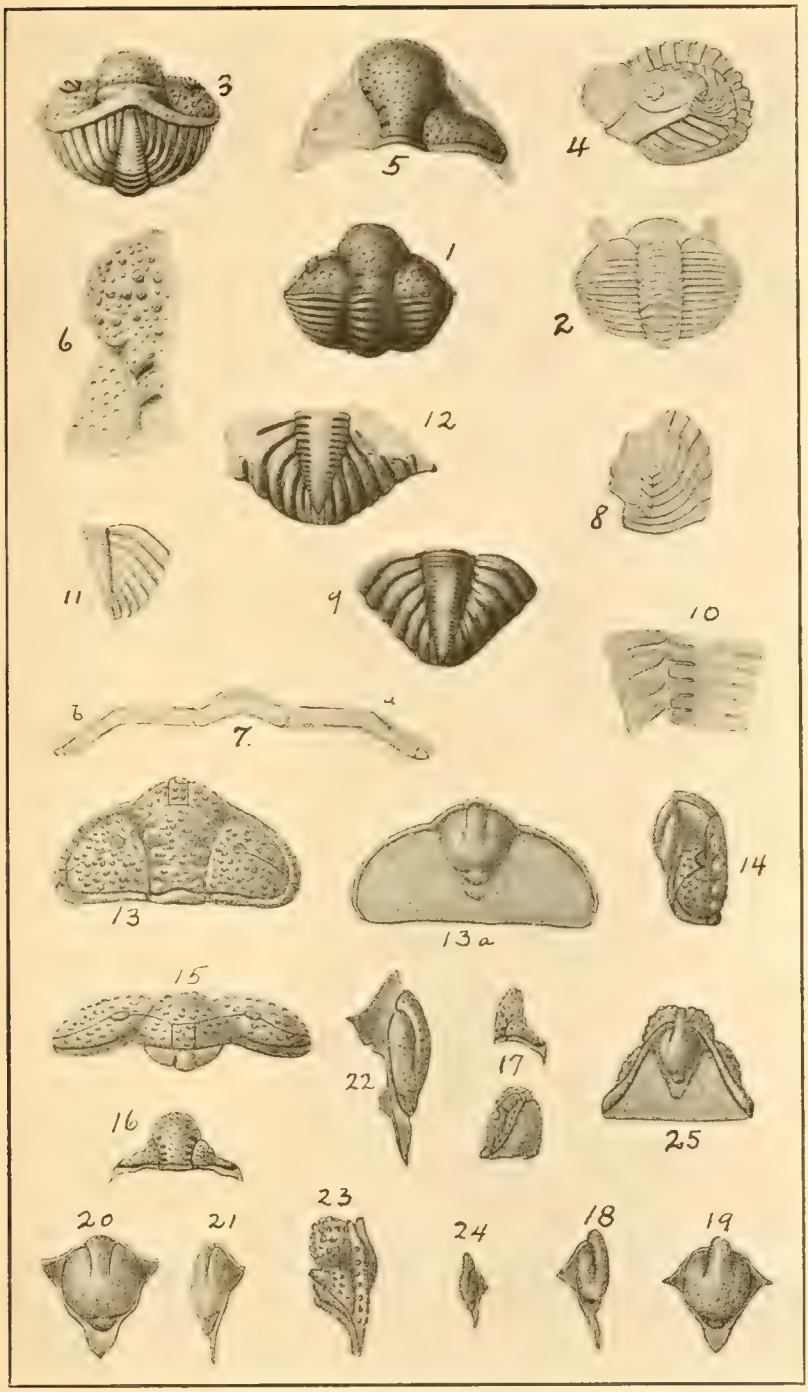
Fig. 20. Encrinurus (Cromus) Bohemicus, Barr. Front and side view of the hypostoma.

Fig. 21. The same.

Fig. 22. Encrinurus (Cromus) intercostatus, Barr. The hypostoma.

Fig. 23. Encrinurus punctatus. Side view of head.

Fig. 24. Side view of hypostoma.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Explanation of Plate III.

Cryptonymus variolaris, Brong.

Fig. 1. A young specimen.

Fig. 2. Rolled up specimen.

Fig. 3. The head and thorax. The segments are slightly bent backwards; it shows the sharpened front edge, and notched termination of the pleurae.

Fig. 4. A rolled specimen, nearly full-grown.

From photographic plates of Fletcher's plate 32.

Fig. 5. Head, showing anterior course of facial suture—after Salter.

Fig. 6. The same: a, side view; a-a, facial suture.

Fig. 7. Side view—after Fletcher.

Fig. 8. Shows front part of head and hypostoma—after Fletcher.

Fig. 9. Under side of the pygidium.

Fig. 10. The pygidium—after Herrman's illustration, 1711.

"*Pectunculites marmoreus trilobus imbricatus.*"

Fig. 11. The pygidium—after Linné's figure, 1759. Entomolithus paradoxus.

Fig. 12. Pygidium of *E. multi-segmentatus*, Portl.—after Roemer.

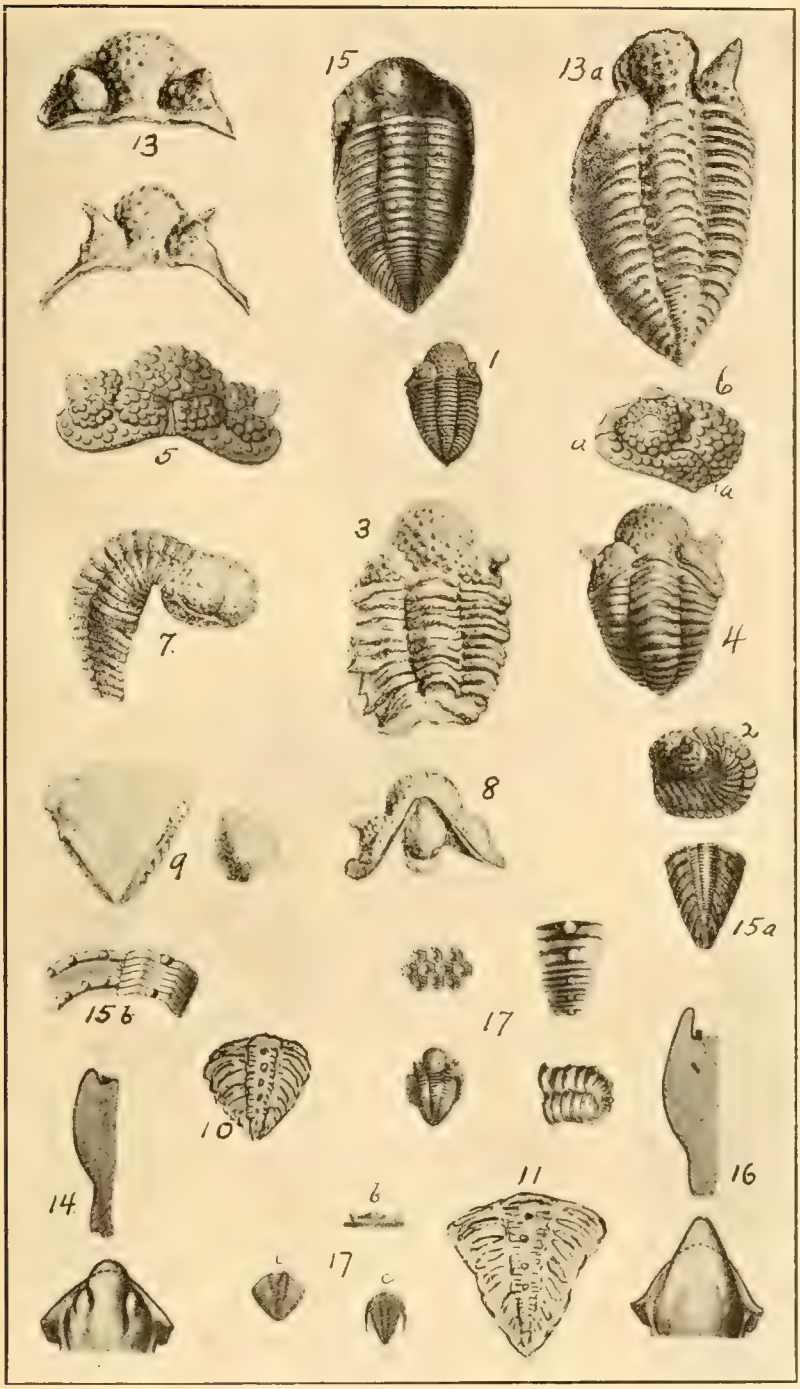
Fig. 13. Encrinurus Eagani, Miller—after Miller's plate.

Fig. 14. Hypostoma of *E. obtusus*, Ang.; front and side views.

Fig. 15. Encrinurus ornatus, Hall & Whitfield; from Clinton, Gr. N. Y.—after Hall's plate.

Fig. 16. Hypostoma of *E. Leavis*, Ang.; front and side views.

Fig. 17. Cybele vigilans, Hall, Trenton, a–g, N. Y.—after Hall's plate.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I—PERCY LEONARD

The Honey Ants of Point Loma, California.

II—HENRY HEMPHILL

Descriptions of Some Varieties of Shells, with Short Notes on the Geographical Range and Means of Distribution of Land Shells.

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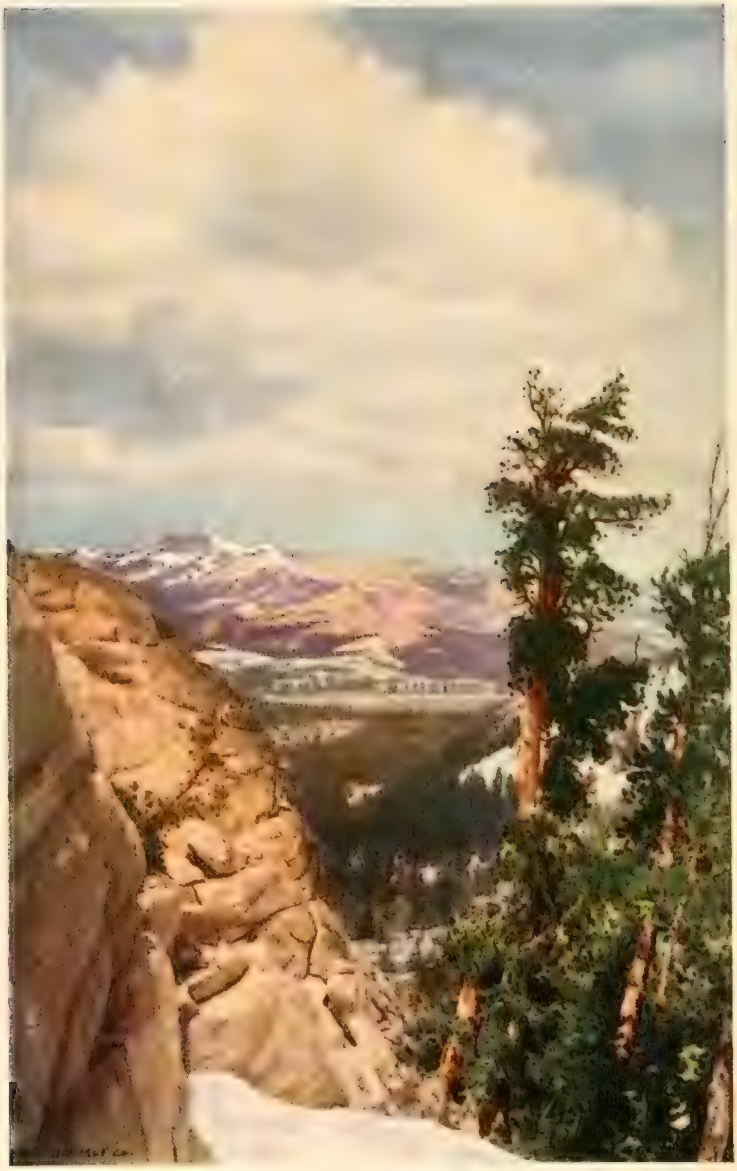
Photographing "Red Snow" in Natural Colors.

TRANS. SAN DIEGO SOCIETY OF NATURAL HISTORY
Vol. 1, No. 3. 1911. Pp. 85-113



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"RED SNOW" (*SPHÆRELLA NIVALIS*)
on Lambert Dome, Tuolumne Meadows, Yosemite, July 19, 1911. Photographed in colors from nature by Ford A. Carpenter, U. S. Weather Bureau

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The Honey Ants of Point Loma

BY PERCY LEONARD

Ever since Llave first described a Mexican honey ant in 1832, these insects have been more or less before the public notice, and yet there are many obscure points to be cleared up in respect to their habits.

The following notes are a contribution to the subject, and are based upon nearly a year's observations of these ants, both in the wild state and in captivity.

In opening up a nest of honey ants, we are liable to meet with six distinct phases. Firstly, and most numerous are the workers, the undeveloped females which occur in three sizes, the majors, the minors, and the minims; and the so-called "queens", who exercise no regal power, but are simply the egg producers and mothers of the community. They have deprived themselves of their wings and inhabit the darkest recesses of the nest. Next come the virgin females, adorned with gauzy wings of great beauty, and lastly, the almost brainless males, likewise provided with wings. (Fig. 1.)

Fig. 1. Winged female of Myrmecocystus mexicanus mojave. Major, minor and minim workers. Two replete majors and a nodule brought out of the nest.

Besides these we find the repletes, which are not, however, a distinct phase, but are simply workers (usually majors) whose crops are so distended with honey as to justify their generic name Myrmecocystus (i. e., ant bladders). These ants have evolved their distinctive habit with reference to climatic conditions. In the Californian springtime the hills are covered with flowers and flowering shrubs. The juicy shoots of many plants are also infested with aphides, which excrete the "honey dew". These insects use only a part of the sweet sap sucked from the growing shoots, the surplus being excreted, and

the foraging ants lap it up from the surface of the leaves, or directly from the excretory orifice of the aphides. The quantity of syrup thus produced is extraordinary. As an extreme case we may mention an aphis living on the sugar maple which excretes forty-eight drops in twenty-four hours.*

Fig. 2. Replete majors hanging from the ceiling of subterranean honey vaults.

During the season of plenty, a certain number of the workers, usually majors, are set aside to store up the supplies collected by their foraging sisters. They hang motionless from the vaulted ceilings of the underground chambers (Fig. 2), and are always ready either to relieve a returning collector of the contents of her crop or to regurgitate a drop or two to feed a hungry member of the community. The swallowed honey is not "consumed"; but simply stored. It remains in the crop, and is returned to the mouth in the same condition as when first swallowed. A minute quantity is of course passed on to the stomach proper, for the sustenance of the individual, but the crop contents are available for the use of the community "on demand".

The tendency to active exertion, common to ants, is held in abeyance, and the patient replete resigns herself to the monotonous occupation of serving as a simple container for the fluid wealth of the community.

During the dry season, the whole community depends upon the honey stored in the repletes, supplemented by dead bees, wireworms and other insects. The replete when appealed to by the antennae of another ant opens her mandibles to their fullest extent, and the recipient sucks up the honey with mandibles almost shut. In two or three minutes the meal is over, and it is usual for the party served to lick

*Ants, Their Structure, Development and Habits. Page 341.

the replete all over and massage the abdomen, as she is powerless to perform her own toilet. The crop, which expands to fill almost the entire gastric cavity, has no glands discharging into it, and as its walls are composed of non-absorbent chitine,* it is to all intents and purposes as cleanly a container for fluids as a glass bottle.

MYRMECOCYSTUS MEXICANUS MOJAVE

Early in March, 1910, some boys of the Raja Yoga School at Point Loma, San Diego, brought me some honey ants. Their gasters looked like partly deflated bladders or half-dried raisins. This was because their honey contents had been almost exhausted by the winter consumption of the nest, and the spring blossoms having not yet opened no fresh supplies were available.

It is a golden moment in the myrmecologist's career when, with a few blows of a mattock on the hard, tough, sandstone subsoil, he lays open the honey vaults. In the bright sunshine the repletes glitter like jewels. They look like highly-polished amber beads, clear and translucent, as they hang from the domed ceilings. So firmly do they cling that only one or two are dislodged by the shock of the mattock. Many of the workers huddled together, like frightened sheep, in one of the chambers, and made no effort to defend their citadel, but, doubtless, they were paralyzed by the sudden glare. All the chambers and passages were spotlessly clean and absolutely free from smell. Although they look quite helpless, the heavily laden repletes are perfectly well able to regain their position in the dome when shaken to the floor. Wm. M. Wheeler comments on the need of keeping the nest dry to prevent the crumbling of the walls and to prevent the growth of moulds on the repletes.† My observations, continued daily for nearly a year, have convinced me that they actually *prefer* a moist soil. I have found many chambers of repletes about four inches below the surface of the flower beds, in a garden which is repeatedly irrigated during the summer months. A wild nest under observation was situated at the bottom of a steep bank where it received not only its own rainfall but the surface water shed by the adjoining slope. The soil crumbles very readily when moist, and how the nest escaped disaster is not very apparent, nevertheless, it appears to be a strong and populous formicary.

At first it seems almost incredible that these ants, whose mandibles cannot pierce a plum skin or the rind of a pear,‡ should be able to

*Ants, Their Structure, Development and Habits. Page 33.

†"Honey Ants, with a Revision of the American Myrmecocysti." Page 380.

‡Ants, Their Structure, Development and Habits. Page 177.

drive tunnels in the hard sandstone subsoil. The sandstone, however, must appear to the ants as lilliputian masonry, the stone being represented by the sand grains, the mortar by the yellow clay which binds them together. It is not a question of cutting through the tiny blocks of silica, it is only necessary to moisten the clay matrix with saliva and remove the loosened grain. Lafcadio Hearn's statement that ants can bore tunnels in the solid rock is therefore seen to be misleading. Wm. M. Wheeler states his belief that the relatively large nest opening is an adaptation for increasing the ventilation.† My own view, based upon observation, continued for many months, is that the large entrance is required for the removal of nodules of iron encountered while excavating. During the hot weather of July and August the entrance was almost entirely blocked up with little clods; but when the first autumnal rain fell, softening the soil and favoring excavation, the hole was enlarged to a size somewhat greater than that of a ten-cent piece (which measures eighteen millimeters, in diameter). (See fig. 3.) Six or eight workers unite their efforts to drag out a nodule. Each grasps it on its equatorial line with her mandibles, and their bodies radiate outwards from this center like the spokes of a wheel Those in front drag, while those behind push, and after very heavy exertions the heavy burden is deposited outside the entrance. To allow egress for a team of eight workers surrounding a nodule necessitates a commodious gangway. The constant stream of ants circulating through the galleries is probably sufficient to prevent the accumulation of stagnant air. The nursery chambers are invariably situated in the upper

Fig. 3. Nest entrance of Myrmecocystus mexicanus mojave, with a ten-cent piece (18 mm. dia.) for comparison. A winged female lies on the coin.

†Ants, Their Structure, Development and Habits. Page 375.

portion of the nest, and one may sometimes see a worker carrying a cocoon outside the nest as if to give it an airing.

One usually associates ants with dry weather and sunshine, but these ants come out only at night. A thick fog drifts in from the ocean spangling the scanty grass blades with glittering drops. The landscape is shrouded in darkness; but the little circle, illuminated by the lantern, is a scene of bustling activity. A constant stream of amber-colored ants pours out of the entrance hole, each carrying a small pellet of sand-grains in her mandibles. Some leave their burden just outside, others laboriously plod as far as three or four feet before they drop their load and hurry back for another. The underground workings are being extended almost every day in the year. I have seen the ants at work at 9 p. m. in the pouring rain and at a temperature as low as 44° Fahr. They do not leave their holes until about half an hour after sunset. Thus they escape the birds and the lizards, their only enemies being the night-prowling toads, and ant lions.* If we smear a little honey on a piece of glass, it is quickly surrounded by 40 to 50 ants, who climb upon each other's backs to reach the tempting fluid. In two or three minutes they are loaded to the limit of their capacity, and then they stagger off towards home. They are perfectly ready to regurgitate, when appealed to on their way by a hungry comrade. The ant's antennae, in which the "contact-odor" sense resides, are constantly being cleaned to free them from dust, which must dull their sensibility. The eggs and larvae are continually being licked over, probably as a sanitary precaution to prevent the growth of moulds, to which they are very subject in the damp recesses of the nest.

As evidence of individuality in character I give the following anecdotes.

An ant had fallen into the moat surrounding my artificial nest and was rescued in a moribund condition, and laid upon the surface of the island. Two of the workers came up, inspected the sufferer and passed by without the slightest effort to help. Presently a minor worker arrived and showed the liveliest concern.

For many minutes she vigorously kneaded the patient's gaster, and worked the stiff legs until at last the half-drowned ant revived.

On another occasion, after a team of six workers had deposited a nodule outside the nest opening, one major stayed behind and by strenuous exertion dragged the load one-third of an inch further away. Its exact location was a matter of absolute unimportance; but the major's notions of exactitude had to be satisfied.

*Since writing, my nest was raided by driver ants (Eciton sumichrasti) on June 12th, 1911. The invaders poured into the nest and emerged carrying larvae. They were repulsed by spraying them with kerosene oil. "The ant's most dangerous enemies are other ants, just as man's most dangerous enemies are other men."—Forel.

For more than nine months I was unable to get the least indication as to the source of their honey. Occasionally foraging ants would drag a dead bee or other insect into the nest; but I could never find any foragers returning with distended crops.

On March 16th, 1911, however, it seemed as if the whole population was on the move, and streaming up and down the trunk of a neighboring pepper tree (schinus molle). An examination of the tree by daylight showed a quantity of blossoms, but I could find only one or two scale insects. My captive ants greedily lapped up the nectar from these flowers. I have found these ants "milking" the aphides upon roses and carnations at night. It is probable that almost all the wild flowers are visited by the foraging ants. I know they get nectar from the "rattlesnake weed" (Euphorbia setiloba), the honey plant (Echium simplex, a cultivated flower), and the blossoms of that fragrant wild shrub, Ceantothus cuneatus. As evidence of the stay-at-home habits of these ants, I can certify that a honey plant was in full bloom twenty-seven feet away from their nest and yet it was three weeks before the foragers discovered it.

The honey stored in a replete of average size I found to weigh 0.1885 of a gramme, and if we take McCook's figure of 600 repletes in a nest of the horti-deorum variety* to be approximately true of M. M. Mojave, this would give us 113.10 grammes, or a grand total of about a quarter of a pound of honey. Small though it may appear to us, I fancy that the knowledge of a share in this provision imparts a certain dignity to every individual member of the nest.

These ants do not display such a wolfish eagerness to acquire chance scraps of food, as is shown by other species, who live from hand to mouth. To show the inoffensive character of the ants under consideration, I may mention that once a troop of little black ants (Darymyrmese pyramicus var. niger) gathered round to lap up some honey which I had put at the nest entrance, but there was no resentment expressed towards them.

When watching the nest at night one may sometimes see crickets hop about among the ants who cover the ground outside the entrance; but no notice is taken of these intruders, and they hop away in a leisurely manner. Once I saw a tiny cricket emerge from the nest among the moving throng of ants, and markedly differentiated from his companions by his sudden, jerky action of progression. He skirmished about for a minute or two and then retreated down the hole. Evidently he was one of the "pets" of the nest.

Among the solitary insects, such as the flies, the moths and beetles, only a very small percentage of their numerous offspring ever reach

*"Nature's Craftsmen." Page 104.

maturity, owing to parental neglect. Among ants, under favorable conditions, the infant mortality is practically nil, so that if every female produced eggs the population would very soon outrun the means of subsistence. It has been very plausibly suggested that the ants regulate the supply of "queens" by rearing a selected number of female larvae on a full diet, while the great majority of them are so insufficiently nourished that their reproductive organs never develop. The feminine trait of taking delight in nursing the larvae survives, however, in its full strength in these stunted females, and they devote themselves passionately to the care of the little, white, semi-translucent grubs, which resemble a crook-necked squash in general form. I think I have never looked into my artificial nest at any time during the day or night without seeing the nursing ants employed in caring for the larvae.

On October 28th, 1910, I caught a worker near my wild nest who was carrying about a cocoon in her mandibles. I placed her upon the island nest, where a quantity of other workers were wandering about, not yet having begun to excavate tunnels. There arose immediately a tremendous competition to nurse the cocoon. The lucky possessor was constantly surrounded by eager applicants for the privilege. Sometimes they showed their impatience by stamping violently on the ground or jerking their bodies forward in their uncontrollable desire to caress the helpless pupa. A few days afterwards the covering was stripped off, and the pale, unfinished infant was carried to and fro without a moment's peace, as one ant after another acquired possession of it. Every worker wanted to be good to it and in the end it died, killed by kindness. If the care of the luckless pupa had been entrusted to one nurse all would have gone well, but by a perversion of the nursing instinct a tragedy resulted.

On October 16th, 1910, after the first real rain of the winter season, I noticed a number of ants peeping out of their hole in great excitement. To produce the effect of nightfall I inverted a box over the entrance. On raising the box after a few minutes I saw the ground alive with ants and among them a virgin queen, which I secured. This is the first capture of this phase of M. M. Mojave. The general coloring and markings remind one of a wasp. (Fig 1.) Although many nests have been searched, only two queens of this species have been found.

During the hot dry spell of weather at the end of August, 1910, the ants stayed underground. The entrance was almost closed with little clods of earth, which seems to show that the extraordinary large nest opening is needed not so much for ventilation as to afford egress for ants removing nodules.

For some time I had noticed ants come out of the nest carrying what seemed to be the corpse of ants in their mandibles. I casually noted that they dropped their burdens and returned to the nest. Later on, I discovered that these burdens were *live ants*, and that when deposited, both parties plodded away in opposite directions without showing the slightest trace of emotion. Other observers who have witnessed similar occurrences have thought them to be a kind of play; but what I saw was much too solemn to be called a frolic. I would suggest that the ants carried out were "callows", that is ants newly emerged from the chrysalis, and that after being allowed to harden their shells for some days in the shelter of the nest they were thus formally introduced to the outside world as a hint that they might now undertake the regular work of the nest.

Professor Wheeler has established the fact that it is only "callows" which are capable of becoming repletes. Once an ant gets thoroughly matured and hardened it appears to lose the elasticity required in order to allow of the enormous distention of the crop which characterizes the replete. An ant in process of becoming distended

Fig. 4. Five replete majors of Myrmecocystus mexicanus mojave posed on a string.

to the proportions of a replete can never be confounded with a replete who has fed away her store and is slowly collapsing to her normal condition. In the former case the gaster is tense and more or less spherical (Fig 4), in the latter the skin is corrugated into folds and the segments stand out as ridges.

MYRMECOCYSTUS MEXICANUS

These ants have never been found in the United States until 1910, and our discovery of a nest on Point Loma was the third reported occurrence of this species in the year.

On November 6th, I dug up a nest in a soil composed of disintegrated shale. They are hardly distinguishable to the casual observer from the preceding species, except by a slightly darker color.

Fig. 5. Winged females of Myrmecocystus mexicanus. Partially deflated replete majors, males, and major, minor and minim workers.

There were many semi-repletes moving about the galleries (Fig. 5), and about eight laying females.

When opened up, the resulting hole was only three feet deep and two feet in diameter evidently a new nest. The laying females, in pleasing contrast to the queens in a beehive, are very friendly and spend hours with their heads together, caressing one another with their antennae. On January 30th, 1911, I found a solitary female in a little hole in a bank. The excavation could not have been more than a day or two old. Had she been undisturbed, in due time a new colony would have been produced by her unaided efforts.

Shortly after I had established an island nest in a basin and had moistened the earth, a minor worker was struck with the idea of sinking a shaft. Accordingly she scratched away at the soil, using her fore legs just like a terrier. Her energy was so infectious that a major joined her, and presently a minim was drawn into the undertaking. Ants digging in pure sand are obliged to remove it grain by grain, but the slightest admixture of clay permits the formation of pellets thus enormously economizing labor. The loose dirt is first scraped into a heap under the ant. The gaster is then curved forward and downward as in the act of stinging* and the front pair of legs is used to pat the earth against the opposing lower surface of the gaster. The loose soil granules are thus packed into a solid pellet, which is seized in the mandibles and carried out. When digging a gallery against the inner wall of a glass tumbler, the digging consists for the most part in tugging at the sand grains and detaching them by main force. The gallery is afterwards enlarged to give passage room for the females. One of the nests under observation had its entrance

*N. B. No ant of the Subfamily Camponitinae, to which the genus Myrmecocystus belongs, possesses any sting. They have a large poison bag, the contents of which are used to spray their enemies and their prey.

against the edge of a level slab of smooth concrete, so that the circular area over which the ants deposited their excavated soil was divided into two parts; one extended over a flower bed, the other over a surface of cement.

Every day the concrete slab is swept, so that on any given morning the loose earth is exactly half of the total amount brought up during the preceding night. On January 24, 1911, the radius of the circle of debris was 7 feet, 4 inches. The night had been calm, so that in sweeping up the deposit I am sure that I collected no wind-borne particles. The weight was 23.6489 grammes, and by doubling this figure we get the total output of loose dirt for the night. When poured into a cubic inch measure it almost exactly filled it. Under favorable conditions, therefore, these ants can excavate nearly two cubic inches in a night. During a colder night, a few days previous, the radius of the circle was only 4 feet 8 inches. Quite early in the evening, some ants will be seen travelling to the very circumference of the circle, passing by bare spaces where we might imagine they would be perfectly justified in getting rid of their load.

Prof. Wheeler, in speaking of repletes, remarks that they "are of course imprisoned for life"; but I have found my ants gradually resume their original figure when their contents are exhausted. In the nest I excavated November 6th, 1910, there were two or three dozen semi-replete majors whose gasters were no larger than those of the fertile female's and who could walk about quite freely. Others had apparently been entirely emptied, owing to the lapse of time since the spring honey harvest and their gastric segments were in a distressing condition of misfit. They did not overlap smoothly, but

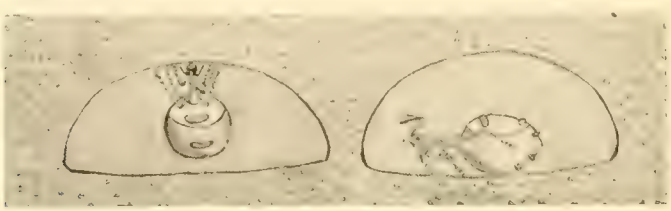

Fig. 6. Replete major of Myrmecocystus mexicanus unable to regurgitate honey while hanging, and who has to assume a recumbent posture before she can feed her sister workers.

were warped and twisted out of shape. But another course is open to a replete who finds her honey content diminishing. *She may swallow air* and thus maintain her size. (Fig. 6.) This is done by both M. M. Mojave and the present species. In my artificial nest I found a full-sized major replete three-quarters full of honey, and

with an air bubble occupying the upper region of the crop. I stinted supplies of honey to bring about diminution of her stock, and as she fed away her store the air bubble increased, until it filled three-quarters of her capacity, while the remaining quarter of honey lay in the lowest part of the crop.

I now frequently found her lying on the floor of the little grotto where she lived, with six or eight workers gathered around to be fed. The reason for her recumbent posture is at once apparent. So long as she was hanging from the ceiling, the air bubble occupied the upper portion of the crop, and her efforts to regurgitate honey could only result in an escape of the imprisoned air; but if she lay upon her side, or ventral surface, on the principle of the spirit level the air rose to the highest point of the gastric wall and then any contraction of the proventriculus, or pumping stomach, forced the honey out at the mouth. Contrary to the observations of McCook on the hortideorum variety, I have found that these ants very economically lap up the honey contents of dead repletes, after depositing the heads and thoraces in the moat round their nest. It was very amusing to watch the workers of this species feeding their larvae with eggs. The nurse holds the egg in her jaws and squeezes it into the mouth of the helpless baby, who shows great eagerness to be fed. After the larva has got what it can, the nurse cleans out the shell, and regurgitates the remnant into the larva's mouth. Frequently the nurse sticks an egg on to the back of the larva's neck by saliva, so as to have it ready for the next feeding time.

Although these ants have no stings, they can spray some poisonous fluid into the wounds made by their mandibles, from a gland situated in the tip of the gaster. Two caterpillars, an inch and a half long and a quarter of an inch in diameter, succumbed to the spray in a few minutes, and were dragged down into the nest for food. It is quite common to find dead insects, termites, flies, etc., lying among the larvae, and in wild nests and among captive communities it is usual for two or three repletes to hang from the ceilings of the nursery chambers. Sometimes the larger larvae remain for a long time with their heads thrust into the thoraces of dead flies, devouring the muscular tissue.

The high development of ants is shown by the long period of helpless infancy and absolute dependence upon the care of the nursing workers. Although they lie upon the bare earth of their caves, they are protected from actual contact with the soil by stiff bristles which are set in their soft skin, and which allow of a free circulation of air all round them. Living as they do in damp subterranean caverns they are peculiarly liable to be attacked by various moulds, and it is

for this reason that the nurses are indefatigable in licking their charges to remove the spores from which these vegetable parasites take their rise. Larvae isolated from the attentions of the workers very quickly succumb to these exhausting growths. It is probably due to the need of a certain amount of ventilation that the larvae are usually found in the upper chambers, thus presenting a parallel with the case of the short-tailed field vole (microtus agrestis), of England. The ordinary retreat of these rodents is a burrow situated far below the surface; but their young are reared in a nest of split grass, built upon the very surface of the ground. They are exposed to innumerable dangers, of course; but a litter of six or eight young mice would probably be suffocated if confined in a deeply situated nursery.

As showing the preference of these ants for moist surroundings, I may mention that for some months I kept a colony upon a porous earthenware saucer inverted in a basin of water and completely covered by a mound of clay and sand. When I eventually broke up the formicary, I found that the chambers and galleries had all been hollowed out in the soil immediately above the damp earthenware surface, the saucer itself forming the floor. The higher and drier portion of the mound had not been inhabited at all.

PRENOLEPIS IMPARIS

Is found here in great abundance, and is common from the Atlantic to the Pacific. We will content ourselves, therefore, with merely recording its occurrence. It ascends the blue gum, (eucalyptus globulus), and may be found by the dozen resting half hidden among the fragrant anthers.

MYRMECOCYSTUS MELLIGER FOREL

The typical form has not yet been found here, but a variety which appears to be intermediate between varieties testaceus and semirufus has been identified by Professor Wheeler.

MYRMECOCYSTUS MELLIGER LOMAENSIS

Another variety or sub-species has been found here, only previously reported from Riverside and Whittier by Mr. Quayle.

This ant is strictly diurnal in its habits, and has been seen feeding upon the white flowers of mesembryanthemum aequilaterale.

In an artificial nest these ants were fed with a drop of bee's honey in a leaf. Instead of greedily lapping it up, as the first two species here treated of would have done, they became violently agitated. They flung themselves upon the honey and sprayed it with their poison,

snapping at it furiously with their mandibles, and it was some time before they realized that it was good for food. Is it possible that being diurnal in their habits they have a perennial feud with honey bees when they compete with them for the contents of the nectaries of flowers, and that the smell of the honey forcibly suggested bees to their minds, and provoked the customary hostilities? Whereas the honey bees require a hollow tree and household furniture in the shape of waxen cells for rearing brood or storing honey, the ants can carry on their lives with nothing more than food, and a few cubic feet of soil. They use no implements, utensils nor bedding, and the sole garment they require is the swaddling gown of woven silk that wraps them in the pupal state. Ants have no personal ambition. The only end they have in view is to cover the earth with colonies of their own particular species, and urged by this remote, impersonal desire they spend their lives in ceaseless toil. The instinct which impels the ants' unselfish labor is probably as irresistible as that which forces human beings to pursue their personal advantage. The personality of ants appears to be dissolved, and every individual seems to act as if it was the agent for that nameless, universal will that urges on the slow advance of cosmic evolution. Without compulsion or direction their social life is carried on in perfect harmony. Each ant is a law to herself; but as the aim of all is identical, a spirit of perfect harmony prevails. The ants have shown the possibility of a perfect communal life, and have proved that individuals can be incited to the maximum of effort with the minimum of personal advantage, and that the little states based on unselfish sisterhood are supremely fitted to survive in the struggle for existence.

This paper would be incomplete without an expression of grateful acknowledgement to Professor William Moreton Wheeler for his kindness in identifying the various species of ants to which reference has been made. Without this help in naming specimens, and the assistance derived from his correspondence, the production of the paper would have been indefinitely delayed.

The illustrations are from plates prepared expressly to illustrate the text, and are the work of the Lomaland Photo and Engraving Department, Loma Homestead, Point Loma, San Diego, California.

It may be of interest to note that I have in my possession specimens of replete Honey Ants collected at Coronado, San Diego, in 1890, by Dr. F. E. Blaisdell, formerly a member of the San Diego Society of Natural History. They evidently belong to the species Myrmecocystus mexicanus, but whether to the pure type, or to one of the sub-species or varieties, it is impossible to determine, owing to their defective state of preservation.

Descriptions of Some Varieties of Shells, with Short Notes on the Geographical Range and Means of Distribution of Land Shells

BY HENRY HEMPHILL

The study of variation among Mollusks involves the consideration of the laws of life, if one desires to understand or ascertain the cause or causes that produces all this great diversity that we see in every department of nature.

Briefly, life as I understand it, consists of energy moulding matter into form and of expressing through those forms, not only the objects of life, but also the properties of matter.

An organism is a specialized portion of energy and matter, separated from the great mass, and endowed with organs that have functions for performing special work necessary in the economy of the creature, all of which act in harmony with the class to which the organism belongs.

Development is the fundamental law of growth, and nature's great working basis in organic evolution, and should be the working basis of every student of her laws.

Diversity, or variation as it is frequently called, is the detail work of development and evolution, if we can separate the action and meaning of these two closely related terms.

The fundamental law of equilibrium presides over all of nature's laws. It is dual in its activities; radiates, so to speak, from a common center in opposite directions, and adjusts diversity by developing opposite varieties of equal weight, quality value and importance in each class of organisms, and generally maintains or keeps the union or unity of nature complete.

MUREX CARPENTERI TREMPERI, HEMPH.

Murex carpenteri, Dall., has been described as, of a "livid brown color, pinkish towards the apex and whitish around the aperture". I have in my collection one specimen dark reddish brown in color, with a dash of white along the columellar side of the aperture; an-

other with the body ashen white, shading off darker on the varices, and another one of the typical coloring.

Recently I have seen in the very fine collection of Dr. R. H. Tremper of Ontario, Cal., a magnificent series of this and other deep water shells, from the Santa Barbara channel, and perhaps the best collection of these shells extant, in good condition and artistically arranged to please the eye. Among the lot there is a series of Murex carpenteri, about typical in form and coloring, with the addition of three white revolving bands, that expand in width as they pass toward the outer edge of the foliated varices, and show on three of the spire whorls. There are three broad, thin varices on the specimen before me, the edge of the last broken by five rather broad, circular indenta-

Plate 1.—Murex carpenteri tremperi.—Hemphill (Enlarged.)

tions, separated by four broad, rather short, chisel-shaped digitations, curved upward at the ends. The somewhat large basal indentation forms about two-thirds of a regular circle, is one-fourth of an inch across, its edge thickened and regularly reflexed, except next to the long, curved and well-covered canal. The body and varices are quite smooth, except the last varix, which is roughened on the lower side by wavy, file-like striae.

These beautiful shells were dredged in the Santa Barbara channel, off Newport, by Dr. R. H. Tremper, who kindly gave me a specimen and to whom I dedicate this beautiful variety.

OCINEBRA STEARNSI, HEMPH.

The general outline of this small shell is diamond shape, with the side points rounded off. It is composed of six turns or whorls. The

nucleus or embryonic whorls, are white, rather rough, and consist of about two turns. The next whorl has flat sides and a square-edged shoulder and is divided by a small revolving groove into two revolving nodulus riblets with shallow pits, in the interstices. The antepenultimate and penultimate whorls are convex in form and divided into three revolving nodulus riblets by two revolving grooves, with deep, rounded pits in the interstices. The convex body-whorl comprises nearly two-thirds the entire length of the shell with similar sculpturing as that of the two preceding whorls, and with the pits more conspicuous above, than below the periphery of the body-whorl. The suture is distinct and well impressed. The outer lip is very much thickened for such a small shell, its outer edge being faintly denticulated by the revolving ribs and grooves, the inner edge just within the aperture bearing 5-denticles. The form of the aperture is oval, slightly pointed below; canal short and covered. The base of the columella is creased by an umbilical slit. The color is light or dark yellow or brownish, plain or with a single white revolving band at the periphery of the body-whorl, covering one and sometimes two of the revolving riblets.

Length, 18; breadth, 8 mm. Habitat, Monterey, Cal.

This small shell has the general form of O. gracillima, Stearns; the coloring of O. lurida as well as that of O. gracillima, and some varieties of interfassa, but may be readily separated from other members of the lurida group by the pitted sculpturing. I dedicate it to the late Dr. R. E. C. Stearns, in return for many favors of a similar kind.

HELIX VAR. SONOMAENSIS, HEMPH.

Shell rather small, greatly depressed, umbilicated, of a yellowish or buff color, whorls 5½, slowly increasing in size, the last flatly convex beneath, and not excavated around the umbilicus; umbilicus large and deep; suture distinct; aperture rather small, nearly quadrate in form and bearing on its columellar portion a long oblique tooth; peristome slightly reflected, crowding but not covering any portion of the umbilicus, and bearing on its inner side two small denticles, one on the basal, and the other near its upper termination.

Great diam., 8; height 2½ mm.

Great diam., 7; height 2½ mm.

Habitat, near Healdsburg, Sonoma County, Cal.

The larger size, more depressed form, lighter color, and larger umbilicus, will serve to separate this variety from the other known forms of Helix (triodopsis) loricata Gld.

TONITES (CONULUS?) WASCOENSIS, HEMPH.

Shell small, smooth, shining, transparent, perforate, consisting of 4½ or 5 convex whorls—the last a little more tumid than the penultimate whorl; striae of growth very fine, hardly perceptible under a strong pocket lens; suture distinct, well impressed; aperture moderately narrow, semilunar; outer lip simple, acute, not falling at its upper termination; columellar portion of the shell, very convex; base of shell convex, hardly excavated around the umbilicus; umbilicus small and deep.

Great diam., 2; height 1 mm.

Habitat, Wasco County, Oregon; also near Salem, Oregon.

This small shell seems to be new. It has the aspect of Tonites chersennellus Dall., but is about half the size of that shell, with about the same number of whorls. The aperture is narrow and resembles that of L. capsella Gld.

HELIX WALKERIANA, HEMPH.

Shell umbilicated, glaubosely convex, rather thin and somewhat transparent, of a reddish brown or chestnut color; spire elevated with an obtuse apex, or with a sharp pointed apex on the narrow, tall forms; whorls 5½ convex, the last well rounded above and below, descending a little in front, bearing a well defined chestnut-colored revolving band just above the periphery, margined by two light yellowish or horn-colored zones or bands, all three of about equal width. These bands are rarely absent, but when the central band is absent

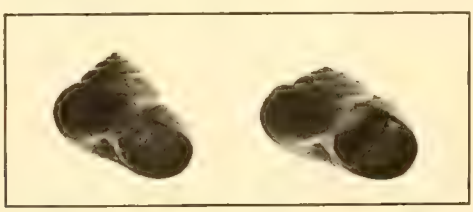

Plate 2—Helix walkeriana—Hemphill. (About natural size.)

the marginal bands coalesce and form a faint light revolving zone. I found but one shell with all the bands absent.

The sculpturing consists of rather coarse oblique file-like striae of growth cut by numerous, rather fine, well impressed but irregularly spaced revolving grooves, forming in some instances parallelograms or little squares, and numerous rude, rather coarse granules, that occasionally coalesce and are arranged along the striae of growth or are scattered over the upper surface of the body whorl. Below the

periphery this sculpturing becomes much modified, and disappears near the umbilicus. The suture is distinct and well impressed; aperture, subcircular and large; peristome simple, very slightly reflected, its ends approaching the basal or columellar end, crowding and half covering the rather small umbilicus.

Great diam., 26; height 20 mm.
Great diam., 25; height 18 mm.
Great diam., 20; height 14 mm.

A very elevated shell measures:

Great diam., 20; height 20 mm.

Two depressed shells measure:

Great diam., 23; height 19 mm.

Two small shells measure:

Great diam., 19; height 15½ mm.
Great diam., 18; height 14½ mm.

Habitat, San Luis Obispo, Cal.

HELIX VAR. MORROENSIS, HEMPH.

This variety of walkeriana differs from the typical form, in having the revolving grooves obsolete, or extremely faint, and more profusely granular.

Great diam., 29; height 18 mm.
Great diam., 22; height 16 mm.
Great diam., 18; height 15 mm.

Habitat, San Luis Obispo County, Cal., among brush and rocks.

This shell and its variety are extremely interesting forms, when one reads and interprets their combinations of characters intelligently. It combines the form, file-like striae of growth, open umbilicus and general aspect of Helix ramentosa Gld., with the glaubose (not typical form), open umbilicus, file-like striae of growth, and the revolving grooves of the typical H. ayresiana Newc.

I dedicate this shell to Mr. Bryant Walker in recognition of his valuable services in the study of conchology.

CIRCINARIA VAR. KELSEYI, HEMPH.

Shell umbilicated, greatly elevated, of a yellowish horn-color; whorls about 5 convex above and below, gradually enlarging, the last sloping rapidly to the periphery; spire greatly elevated, with a medium pointed apex; striae of growth oblique, rather fine; suture distinct but not very deeply impressed; aperture somewhat effuse, roundly oval; peristome simple, a little thickened, outlined by a rim of dark brown epidermis, the ends approaching and joined by a thin parietal callus; umbilicus deep and quite narrow.

Great diam., 15; height 12 mm.
Great diam., 16; height 9 mm.
Great diam., 17; height 10 mm.

Plate 3—Circinaria var. kelseyi—Hemphill. (Natural size.)

Habitat of the most elevated shell, San Mateo County.

Habitat of the other two shells, San Luis Obispo County, Cal.

I dedicate this variety of Prof. F. W. Kelsey of San Diego, Cal., who has taken much interest in the study of shells, and whose photographs of shells are nearly perfect.

HELIX VAR. AVALONENSIS, HEMPH.

Shell sub-lenticular, deeply unbilicated, whitish horn-color. Whorls 5 or 5½, flatly convex above, more rounded beneath, with a sharp carina at the periphery, which becomes obsolete on the last half of the body-whorl of the single mature shell that I have. The sculpturing, under a strong pocket lens, on the nuclear whorls, consists of fine rib-like striae of growth, regular in form and arrangement, that after two or three turns become obsolete and are superseded on the following whorls by very small revolving granular riblets, one of which rapidly develops into a sub-carina with the aid of the pinch of the peripheral carina, making the shell bicarinate as in Helix hemphilli, Newc. The revolving riblets above and beneath vary considerably in strength, number and arrangement.

The whole surface of the shell, except the nuclear turns, is covered with fine, sharp striae of growth, and rather rough indentations that divide the surface of the shell into irregular sections. Beneath the surface is smoother, but under a strong pocket lens, the sharp striae of growth and the revolving riblets give that portion of the shell the exact aspect of Helix haydeni, Gabb. The suture is distinct and well impressed and after three or four turns shows the upper part of the carina as a sutural riblet.

The umbilicus is moderately broad and deep, and in very young shells, it is defined by a blunt carina, but does not appear in the adult shell. The peristome is simple and acute, its upper termination not falling. The aperture is nearly a complete circle, but in immature specimens its outer margin is made angular by the peripheral carina.

Great diam., 14; height 8 mm.

Habitat, Santa Catalina Island, Cal.

The presence of a colony of land shells, living on Santa Catalina Island today, belonging to the strigosa group, whose metropolis at the

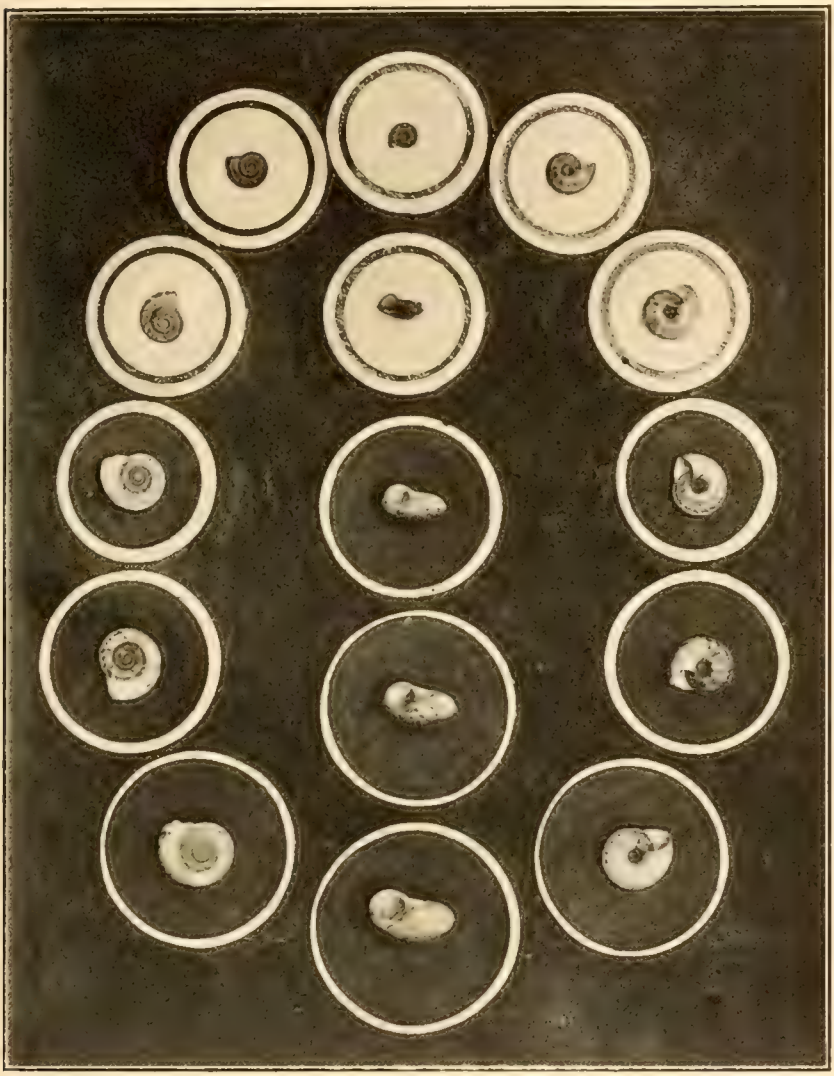

Plate 4—Helix var. avalonensis—Hemphill

present time is several hundred miles distant and northward from this island, at an elevation of from four to eight or ten thousand feet above the sea level, with a great stretch of desert-like country intervening

between the coast and the metropolis of this group of shells, calls for some explanation and remarks on the geographical range, and the means of distribution of such slow-moving creatures.

Undoubtedly in the early history of the continent, it has been elevated and submerged several times above and below the sea level, before the land assumed its present state or condition. The great abundance of marine fossils in the various stratas of rocks in every part of the country, inland as well as along the coast, and in the low valleys as well as on the high mountains, confirm this statement.

Perhaps, after many hundreds of centuries had passed, and during the miocene or about the middle of tertiary times, the continent became comparatively quiet, and when the great lake system of the interior had become well established, and dense forests and rank vegetation had become well developed, and served as food for the great herbiverous creatures of that time, whose fossil remains are found in almost every part of the continent, whose bodies became, in turn, the food of the huge carniverous amphibians that lived in the lakes and low marshy land at that time, and were probably the terror of their day, and whose fossil remains are the wonder of men at the present time.

It is quite possible that land shells and probably Helix strigosa, or its progenitor of large size, may have occupied the higher and dryer areas of the land, as it does today, and became widely distributed by the floods and drainage system of that time, Santa Catalina Island, with the other islands of the Santa Barbara group, were probably high landmarks of a broad range of mountains, at that time, and extended many miles in a northerly and southerly direction, and probably spread out many miles beyond San Nicolas, the outermost island of the Santa Barbara group.

Perhaps, during the latter part of miocene times, this colony of the strigosa group and the other land shells that are peculiar to these islands today, occupied high areas on these mountains. At the close of the miocene period great volcanic disturbances occurred again, when this Santa Barbara range, as it may be called, went down below the sea, leaving the eight islands standing above the turbulent waters, as monuments or tombstones to mark its burial place, where these stranded colonies of land shells have continued to exist but have become somewhat modified in form. Fossil land shells of the present living forms, indicate considerable age and seem to support these assertions and suppositions.

About the time that this western range of mountains became submerged, another and perhaps the last general elevation of the continent took place, when a hundred volcanoes on its western slope,

belched forth a flood of lava that formed high ranges of mountains and laid the rocky floors of many valleys in its flow to the lower levels, and perhaps during this great upheaval the limestone bedrock of the Mississippi and adjacent valleys was pushed up to its present height, out of the sea, which its marine fossils indicate.

At this time it is possible that part or all the continental mountain ranges were raised to their present elevations, probably higher, in which time and the adjustment of the earth's crust to the new order of things after these upheavals, may have made some minor changes.

With this general elevation of the land the barriers that held the waters of the great internal lake system of that time were broken, the water rapidly drained off and the rush of floods cut the river channels that form the drainage system of the continent, which the storms and floods subsequently have completed as we have it today.

As the geographical range of land shells is a question of considerable importance to conchologists, I wish to call especial attention to the rivers and drainage system of the continent, as the principal avenue and means of distribution of these slow-moving creatures.

Little study of the map of North America will show that all the principal rivers that form the drainage system of the continent have their source in the district formed by, or near, the union of the states of Idaho, Montana, Wyoming, Utah and Nevada. These rivers flow to the Arctic ocean at the north, to the east and south, into the Atlantic, to the southwest, the west and northwest into the Pacific ocean, and curious enough, this district, the source of all these rivers, is also the metroplis of all the genera of the universally distributed American land shells. I have collected in this district myself, the following genera: Succinea, Vitria, Tonites, Circinaria, Helicodicus, Patula or Pyramidula, Polygyra, Vallonia, Pupilla, Cochlicopa, Polygyrella, Hemphillia and Prophysaon.

The last three genera, however, are confined in their geographical range to the western slope of the continent so far as we know at the present time.

There is little doubt in my mind, that the universally distributed genera and species have been scattered over the continent principally by the drainage system.

During heavy storms and great floods, whole colonies, as well as individual shells, are washed into the streams with the woodland debris and carried far away from their native haunts in the higher areas of the mountain districts, to the lower levels of the valleys, where lodgments are made, and colonies are formed, perhaps after many failures, but in the course of time become permanently established and spread over the adjacent territory.

Here under the constant stress of changed conditions in the environment, principally perhaps, by the chemical affinities contained in the food and atmospheric conditions, the progeny of the newly established colonies become modified wholly or in part as the adjustment of the organism to its environment demands and requires.

This manner of distribution by the drainage system has been going on for ages, and is still scattering the slow-moving creatures over the face of the land, and it is not strange and no wonder that we meet with similar shells, high up on the mountains, low down in the valleys, far up in the cold north, away down in the hot south, back in the effete east, out in the wide west, as well as on the beautiful islands of the sea.

Photographing "Red Snow" In Natural Colors*

BY FORD A. CARPENTER

On July 13th, 1911, as we were encamped on the shores of Lake Merced in the Little Yosemite Valley, the advance party of the Sierra Club returned with the news that "red snow" was visible for many miles over the Vogelsang pass. At the campfire that evening, Dr. C. A. Kofoid, professor of zoology at the University of California, gave an informal talk on *protococcus nivalis*, or, according to the new nomenclature, *sphaerella nivalis*, popularly known as "red snow". He called attention to the fact that this phenomenon was unusual even in the mountains of the Sierra Nevada, and that the members of the Sierra Club were fortunate in having the privilege of viewing this interesting species of algae. Dr. Kofoid's talk aroused the anticipation of the members so that it was discussed in many of the detached groups as they clambered over the Vogelsang trail early the next morning on their 20-mile jaunt to the Tuolumne Meadows.

It was not at all remarkable, however, that with the magnificence of the panorama spread before them on approaching the rugged Vogelsang Pass, that the phenomenon of colored snow was almost forgotten. In fact, our party first noticed it while following in the trail broken by the pack animals. The trail led through several miles of deep snow into which the pack train plunged heavily at every step. Several of the hoof-prints were splotched with red as if the snow crust had cut the mule's feet and dyed the snow with drops of blood. Then it dawned upon us that we were witnessing that alpine curiosity, *sphaerella nivalis*. The place where the first *sphaerella nivalis* was observed was in the nearly perpetual snowfields on the saddle of the Vogelsang Pass. This Pass has an altitude exceeding 10,000 feet and the surrounding peaks and crests are rugged and forbidding. Owing to the length of the day's march the party could not linger on the trail, but tramped steadily forward to that night's camp at the Tuolumne Meadows.

*See frontispiece.

It was on the summit of Lambert Dome, which is the dominant feature of the Tuolumne Meadows, that the photograph which accompanies this article was taken. Lambert Dome is a solid mass of granite, rising a thousand feet above the Tuolumne River that skirts its base. It is a rock which has withstood the grinding of the glaciers of the past, and shows on its crest glaciated patches polished to a mirror-like surface. While the Sierra Club was in camp across the river at the Tuolumne Meadows, Lambert Dome was the objective point of many short climbs. It was during one of these excursions that patches of *sphaerella nivalis* were found. To quote from my note-book under date of July 16th:—"On the west side of Lambert Dome are patches of 'red snow'. It looks as if carmine ink has been spilled over the snow. The snow-drift, splashed with red, is in the immediate foreground, the tall pines on one hand, and the precipitous sides of the Dome on the other inclose a vista of deep green tree-tops and meadow, through which meanders the silvery Tuolumne River. The purple foothills flank the snowy glacier-scarred peaks that pierce the sky: the whole is overhung with slowly drifting cumulus clouds." It was under these picturesque circumstances that the first photograph of "red snow" was ever made in natural colors.

One of the most prominent members of the 1911 outing of the Sierra Club was Dr. W. L. Jepson, of the botanical department of the University of California.

Upon request he furnished me this memorandum on *sphaerella nivalis:* "'Red snow', *protococcus nivalis*, or according to the latest nomenclature, is *sphaerella nivalis*. The cells are spherical and have no power of motion in the frozen snow, but in the summer, when the snow melts, the cells become vegetatively active, increase in size, and, after the fashion of the simple algae, divide into usually four, or six, or eight (or even two daughter) cells. These daughter cells escape from the original cell, and by means of rotating hairs at one end, they have the power of motion through the melted film of water, which fills the spaces between the particles of snow on a warm summer's day. The cells secure their nourishment partly from the water, and partly from the atmospheric dust which always lies on the snowfield, and which becomes dissolved in the film of melted snow."

The color-plate of *sphaerella nivalis*, which forms the frontispiece of this volume of the transactions, is a direct reproduction from the original photograph made by the Lumiere process in natural colors. The apparatus used in making this autochrom was a 3¼x5½ camera fitted with a No. 1, Series III, double anastigmat, F 6.3, 6 inch focus, diaphragmed down to f24. The autochrom was given an exposure of 6 seconds. This relatively long exposure was necessary on account of

the yellow-orange rayfilter which was fitted to the lens in order to equalize the intensity of the light and compensate for the predominating actinic effect of the violet and blue rays. The plate was developed in a metroquinone solution, cleared in potassium permanganate and reversed by re-development in the monomethyl-para-amidophenol sulphate and hydroquinone.

Six years ago the writer exhibited before the San Diego Society of Natural History several direct-color photographs of still life such as fruit, flowers, etc., but at that time the process required an extremely long exposure through thick color filters, which made it impractical for landscape photography. One of the photographs shown at that time was a study of a few clusters of Tokay and Muscat grapes; this picture required an exposure of 40 minutes through the orange-red filter, and proportionate exposures when using the green and violet filters.

In the Lumiere process the procedure is rendered very simple and the speed is only about two hundred per cent. greater than in ordinary photography. Through the courtesy of the brothers Lumiere the following outline of the process is given herewith: "Autochrom plates differ from ordinary plates as follows: Interposed between the sensitive coating and the glass is a thin layer of transparent miscropical starch grains, dyed *orange-red, green and violet*, spread without overlapping, and mixed in such proportion that the layer appears colorless when examined by transmitted light, and absorbs but a small percentage of the light received. The sensitive coating is extremely thin, and made of a special fine-grained panchromatic emulsion. When such a plate is exposed in the camera, the glass side towards the lens, the light, before reaching the sensitive coating, passes through the colored starch grains, which act individually as minute screens, each one absorbing all colors but its own. A microscopical selection takes place, and after development there is found under each grain a corresponding black spot, reduced silver of a density proportionate to the amount of color received and transmitted by this particular grain. Were the plates fixed at this stage, the picture when examined by transmitted light, would show only the colors complementary to those in the original, since the true colors are masked by the black spots beneath the grains. But when the reduced silver is dissolved in the permanganate solution, the image is reversed: the opaque image under each grain becomes translucent and transmits colored light precisely of the same hue as the light transmitted by the grain when the plate was exposed in the camera: in other words the color is reconstructed just as it was decomposed during exposure."

While the bibliography of *sphaerella nivalis* includes the writings of the ancient Greek philosophers, Swiss geologists, arctic explorers,

geographers, and modern cryptogramic botanists, it should not be inferred that "red snow" is of common occurrence in alpine regions. In fact, there are not a few Alaskan explorers and mountaineers who have never encountered this phenomenon. Mr. Samuel B. Parish, one of the oldest botanists in the state of California writes that although he has botanized over the greater portion of the state he has not had the fortune to see *sphaerella nivalis*. Mr. Frederic G. Plummer of the United States Forest Service and Geographer of the United States, says, "Although this phenomenon has often been reported by arctic explorers and I have seen it in the alpine regions of Washington and Oregon, it is the first time to my knowledge that it has been seen by a reliable observer as far south as central California. I would be glad to know if there is any reliable record that 'red snow' has been found in still lower altitudes."

In the third century before Christ, Aristotle mentions "red snow" in his "Meteorologies"; Saussure in the eighteenth century hinted at its true cause, Sir John Ross, in his voyage of discovery in the arctic regions in 1819, mentioned finding deep banks of "red snow" on the eastern shores of Baffin's Bay extending for miles; six years later Parry made detailed entry in his journal of observing large tracts of "red snow". In fact, the literature on the subject is quite extensive. Through the suggestion of Dr. Frederic V. Coville, botanist of the United States Department of Agriculture, Dr. Marshall A. Howe, of the New York Botanical Gardens, prepared for this article a complete bibliography of *sphaerella nivalis* as follows:

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TRANSACTIONS

OF THE

SAN DIEGO SOCIETY

OF

NATURAL HISTORY

NOVEMBER 1914

VOL. 2 NO. 1

HEMIPTERA. E. P. VAN DUZEE

MEMOIRS OF MR. HEMPHILL
WITH PORTRAIT

A Preliminary List of the Hemiptera of San Diego County, California

By E. P. Van Duzee, Berkeley, Calif.

The Hemiptera enumerated below with few exceptions were taken by me during my residence in that county from December, 1912, to August, 1914. A few, however, were given me by Mr. W. S. Wright and others, and two or three are from localities just outside of the county. The following notes on localities and conditions are given for the benefit of those living in the east who are not conversant with the physical conditions found there.

Coronado and North Island: Low, flat land, lying between the bay and the Pacific ocean.

Ocean Beach, on the northwest side of Point Loma: Collections mostly made on or about the low sand dunes.

San Diego: Mostly in the fields and canyons east of Thirty-first street, on the chaparral at an altitude of about 300 feet, or along Mission Valley near the San Diego River and on the hillsides and in the canyons opening into the valley.

La Jolla, fourteen miles north of San Diego: Mostly about Scripps Institution for Biological Research, near the beach and on the hills and pueblo lands near by, with an altitude of from 300 feet to 800 feet on Mt. Soledad.

Torrey Pines, six miles north of La Jolla on the sandy hills, altitude about 400 feet, or along the valley of the Soledad River. The chaparral collecting here is the best along the coast in this county.

La Mesa, Lemon Grove and Grossmont, east of the city, at an altitude of from 500 to 800 feet. Here Eriogonum prevails in the chaparral and the best collecting is among the rocky hills about Grossmont.

Lakeside, on the San Diego River, about 20 miles east of the city. Here I worked along the river and on the hillsides north of the town. Altitude about 400 feet at the river.

Foster, two miles northeast of Lakeside and but little higher: Work done on the rocky hillsides up to 2000 feet.

Mussey's, a pretty oak-covered valley two miles farther north on the same creek, with much the same conditions as at Foster's, but better collecting ground: Work here was done in the valley and on the rocky hillsides, especially along the canyon to Barona Ranch.

Alpine, thirty miles east of San Diego, among the hills, altitude 1850 feet: Here there was good collecting everywhere in the little valleys and canyons and on the granite hillsides up to 4000

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feet. "The Willows," two miles farther east, gives good valley conditions.

Hurlburd Ranch, near Descanso, altitude about 4000 feet, with conditions not very different from those found at Alpine.

"Twin Pines," on the road from Descanso to Julien and at an altitude of about 5000 feet. This was the highest point accessible by road in the Cuyamaca Mountains, and the vegetation was quite different from that found at lower levels; pine, broad-leaved oak, alder and cedar trees and many other more northern species being found here, and the insect collecting was distinctive and good.

Pine Hills, near Julien, altitude 4200 feet, was an excellent collecting ground with some of the mountain vegetation found at the "Twin Pines."

In San Diego County the collecting season for Hemiptera extends over the entire year, but most of the species have their regular season depending perhaps more on the rains than on the altitude of the sun. The greater number appear soon after the rains and are "in season" from March to July, while certain species and straggling examples of others may be found until well into October. In the higher altitudes from Alpine into the Cuyamaca Mountains the season is later. Introduced species on alfalfa and other crops are found throughout the year.

The lower lands near the coast are usually frostless or nearly so, but from about 1500 feet up there may be a few frosts severe enough to injure tomato plants if unprotected and most every winter there is a little snow on the Cuyamaca Mountains which may remain on the ground for a day or two. In the severe freeze of January, 1913, the temperature reached 16 degrees in San Diego city and went as low as 6 degrees in some of the neighboring canyons, but the exceptional severity of this freeze is proven by the fact that rubber trees more than fifty years old were killed to the ground; but even these conditions were local and tender vegetation not far distant would sometimes escape almost untouched.

One from the east is surprised to find that with such a climate there is both hybernation and æstivation among the insects. The principal controlling factor here is the moisture conditions. The rains, amounting to from ten to sixteen inches according to altitude, come during the winter months, from November to April, and this rainy season is the time of green fields and of flowers which appear in marvellous profusion and beauty. The young of many plant-feeding Hemiptera appear during February and March, but certain species occur much later.

On the eastern slope of the Cuyamaca Mountains the fauna partakes more of the desert type, but the little collecting I have done at Buckman's Springs and in Pine Valley was insufficient to indicate the character of that fauna. In addition to the species enumerated in this paper I have taken quite a number that I have been unable to determine with the material and time at my disposal.

I wish here to acknowledge my indebtedness to Mr. W. S.

Wright of San Diego, who has turned over to me many interesting Hemiptera and has given me valuable information respecting collecting grounds, and to Mr. J. L. Rose of Alpine, who has very kindly opened his Alpine home to me, where much of my back-country collecting has been done and which has proven an excellent place for Hemiptera work.

This paper enumerates 392 species or distinct varieties, of which 52 are new, and four new genera are characterized: *Pycnocoris, Platycixius, Oeclidius* and *Rhynchopteryx*.

HETEROPTERA

Family SCUTELLERIDAE

1. *Sphyrocoris punctellus* Stal. Mussey's, April, one example.
2. *Homoemus parvulus* Germ. San Diego and Alpine; April.
3. *Homoemus proteus* Stal. Mussey's, August.

4. *Homoemus variegatus* n. sp.

Allied to *proteus* but much smaller; having much the aspect of *Symphylus albomaculatus* Dist., Length 4-5 mm.

Female: Head shorter and broader anteriorly than in *proteus;* black or bronze black, closely punctured and covered with mottled pale pubescence. Antennæ black, the incisures only pale; second and third joints subequal, fifth slightly longer than the fourth. Pronotum proportionately shorter and broader than in *proteus*, the humeral angles a little more produced and the sides more oblique, coarsely and irregularly punctured; color greyish tinged anteriorly with ferruginous, the surface on either side covered with matted pale hairs; disk marked with irregular oblique blackish rays, the most pronounced of which forms an imperfect M across the middle of the disk and includes an abbreviated white medium longitudinal line; on the anterior margin before this dark mark is a pair of roundish black spots. Anterior half of the narrowly rounded lateral margins white, posterior half black. Scutellum shorter and broader than in *proteus*, grey, distinctly punctured with black and varied with blackish arcs; on either side of the base is a white arcuate line ending in a marginal spot of the same color and between which is a vague paler area. These pale marks are really formed by a whitish transverse band across the middle partially interrupted by a transverse brown cloud and two oblique blackish rays; posterior one half largely blackish marked with a triangular whitish apical spot and an obscurely triangular cloud either side. Elytra as in *proteus*, grey and punctured, the costa dotted with black posteriorly and the surface under the scutellum black. Beneath pale along the middle line with a blackish area on either side of the disk, the submargins being ferruginous or castaneous. Middle of the venter with but few black punctures and clothed with a minute pale pubescence. Femora piceous black, pale at base and tip, with a rufous spot beneath; tibiæ and tarsi castaneous, the former piceous within, the latter black at apex. Osteolar canal less curved than in *proteus;* margins of the connexivum var-

ied with black and pale. Rostrum black reaching the hind coxæ.

Male smaller and narrower than the female, the markings much obscured, the scutellum with indications only of the white lateral spots and pale median line, the whitish arcuated basal lines distinct.

Described from numerous examples taken about San Diego on the chaparral. During the spring of 1913 it was abundant but the present season I have seen but few. Females living on the red manzanita bushes become clear castaneous with the characteristic markings much broken and obscured, the clearly marked grey forms were taken on the Adenostoma where their color harmonizes perfectly with their surroundings.

5. *Eurygaster alternatus* Say. Mussey's, Alpine; April to August.

Family CYDNIDAE

6. *Thyreocoris nitiduloides* Wolff. Alpine, on adobe soil, March to June.
7. *Thyreocoris montanus* Van D. Fosters to Alpine, May to October.
8. *Thyreocoris extensus* Uhler. April to October, common, especially at Alpine.
9. *Macroporus repetitus* Uhler. Mussey's, one example taken near a brook in April 1914.
10. *Homaloporus congruus* Uhler. San Diego, May to August, young in August. Taken by Mr. W. S. Wright.
11. *Aethus conformis* Uhler. La Jolla, June, one example.
12. *Pangaeus discrepans* Uhler. San Diego, May, one example taken by Mr. Wright.
13. *Geotomus parvulus* Sign. February to April. Occasional.

Family PENTATOMIDAE

14. *Brochymena quadripustulata* Fabr. Occasional on trees and bushes throughout the year.
15. *Brochymena affinis* Van D. Pine Hills, October, on pine.
16. *Peribalus abbreviatus* Uhler. Mussey's and Alpine; April to August.
17. *Rhytidolomia faceta* Say Salt flats at Torrey Pines, June.
18. *Chlorochroa ligata* Say. La Jolla, September. Also taken on mustard at San Juan Capistrano in June 1914.
19. *Chlorochroa sayi* Stal. July to October; not common.
20. *Carpocoris remotus* Horvath. Alpine, October. One example taken on a Boragonaceous plant.
21. *Euschistus conspersus* Uhler. March to April.
22. *Cosmopepla uhleri* Montd. Alpine and Mussey's, April. From chaparral on dry rocky hillsides.
23. *Thyanta custator* Fabr. Common everywhere. During aut-

umn and winter a green form wanting the red band is common in alfalfa fields.

24. *Thyanta brevis* Van D. Lakeside, October. Taken in numbers from a low Chenopodium growing along the river.
25. *Murgantia histrionica* Hahn. Common everywhere on mustard and on "bladder pod," the latter of which seems to be its native food plant here. It varies widely in color and an unusually dark individual has been described by Prof. Cockerell as var. *nigricans*.
26. *Nezara hilaris* Say. Common.
27. *Dendrocoris pini* Montd. Pine Hill, October; several taken from pine trees.
28. *Podisus pallens* Stal. Common throughout the year. This species is very close to *maculiventris* Say but the black ventral spots are much reduced and the form of the genital pieces is different.
29. *Zicrona caerulea* Linn. Alpine and elsewhere, July, on Eriogonum.

Family ARADIDAE

30. *Aradus falleni* Stal. Mission Valley, San Diego, July.

Family NEIDIDAE

31. *Neides muticus* Say. April to October; not uncommon.
32. *Jalysus spinosus* var. *wickhami* Van D. April to October, occasional.
33. *Acanthopysa echinata* Uhler. Lakeside and Alpine, May to July. This species inhabits a low spiny plant growing on dry granite soils among the bristly flowers and fruit of which it is wonderfully well concealed by its own spiny surface.

Family COREIDAE

34. *Corynocoris distinctus* Dallas. Alpine, July and October. These do not differ from eastern specimens. I hardly think this species can be differentiated from *typhoeus*.
35. *Narnia pallidicornis* Stal. Abundant on cacti, especially the "plate cactus,' from March to October.
36. *Narnia (Xerocoris) wilsoni* Van D. Not uncommon about La Jolla in August on the melon cactus or "nigger head." Also Lemon Grove, February.
37. *Chelinidea tabulata* Burm. Found on stag-horn cactus or Chollas, throughout the year. These western specimens show a strong tendency to darkening of the legs and antennæ, thus exhibiting a decided approach to *vittigera* which may not be distinct.
38. *Ficana apicalis* Dallas. Common in many localities; about half of the specimens have the connexivum immaculate but they do not seem to represent a distinct species.
39. *Dasycoris humilis* Uhler. El Cajon, May, one example.
40. *Darmistus subvittatus* Stal. Alpine, June; one example.
41. *Alydus pilosulus* H. S. Lakeside, October, from the flats by the river.

42. *Tollius setosus* Van D. La Jolla and National City, June.
43. *Harmostes reflexulus* Say. Common and very variable.
44. *Harmostes fraterculus* Say. Mussey's, April 1914. 3 examples.
45. *Aufius impressicollis* Stal. April to October; occasional.
46. *Corizus (Liorhysus) hyalinus* Fabr. Common everywhere.
47. *Corizus (Arhyssus) validus* Uhler. Found in great numbers on a weed, probably a Chenopodium, growing on the flats at Mussey's in October.
48. *Corizus (Arhyssus) lateralis* Say. What seems to be a red form of this species occurs in numbers on Eriogonum from April to July.
49. *Corizus (Arhyssus) scutatus* Stal. Alpine, June, 1913, four examples.
50. *Corizus (Arhyssus) indentatus* Hambl. Coronado and Sweetwater Valley, June.
51. *Corizus (Stictopleurus) crassicornis* Linn. Hurlburd's Ranch, Descanso, October.

Family LYGAEIDAE

52. *Oncopeltus fasciatus* Dallas. June to October; common on the narrow leaved milkweed. Young in July.

53. *Oncopeltus sanguinolentus n. sp.*

Proportionately more slender than our other species; sanguineous, head in part, antennæ, legs, and membrane black, the latter with a transverse white spot. Belongs to Stal's section "a." Length 11 to 13 mm.

Narrower and more elongated than in most species. Pronotum less depressed than in *varicolor*, its nearest ally, sides straight, terete, the adjacent disk little depressed, behind the broad anterior margin more distinctly so; this area bounded behind by two crescentic impressed lines pointing forward. Median carina prominent across this depressed area. Posterior margin on either side of the scutellum compressed and foliaceous. Surface especially of the head and pronotum distinctly hairy as in *varicolor*. Scutellum strongly convex and carinate. Elytra but little widened toward their apex. Membrane long and narrow, surpassing the abdomen by not more than half its length beyond the tip of the corium. Antennæ about as in *fasciata*, shorter than in *varicolor;* first joint surpassing the tylus by hardly half its length. Rostrum, second joint distinctly longer than the third.

Color a uniform sanguineous marked with black as follows; antennæ, legs, rostrum, apex of the tylus, a band on the base of the vertex triangularly interrupted in the middle, the cresentic impressed lines on the pronotum and sometimes a cloud between them, scutellum, or at least its base mesosternum and the membrane. The extreme tip of the abdomen is more or less fuscous and usually the disk of the meso and meta-pleura are blackish and normally there is a black spot on the middle of the costal margin of

the elytra which may be continued in a transverse band entirely across the disk. Before the middle of the membrane is a transverse white mark like that found in *gutta*, and the less mature examples have the basal angles pale.

Described from three male and four female examples taken in Mission Valley within the city of San Diego, early in July, 1913, by Mr. W. S. Wright and the author. All were found on flowers of the milkweed. This conspicuous insect is readily distinguished from any variety of *varicolor* by the characters of the pronotum and the short basal joint of the antennæ.

54. *Lygaeus reclivatus* Say. Found everywhere on Asclepias.

55. *Lygaeus belfragei* Stal. San Diego, January 1913.

56. *Lygaeus melanopleurus* Uhler. Alpine and Mussey's; March to October.

57. *Lygaeus carnosulus* n. sp.

Very close to *lineola* Dallas but differs in being smaller and more clearly marked. Length 4 to 4½ mm.

Color black, uniformly sericeous pubescent giving the insect a greyish look; membrane deep black. Narrow comissural margin of the clavus, hind edge of the corium and apical margin of the membrane more broadly, white; bucculæ, antennal sockets, broad anterior margin of the prosternum and coxal cavities, narrow margins of the meso- and meta-pleura and apex of the orifices, whitish. Pronotum mostly marked with pale sanguinous as follows, a subquadrate median spot on the posterior lobe and a smaller one on each humeral angle, the latter invades the outer field of the propleura and is continued along the side as far as the eye; the anterior margin has a pale line behind each eye and a dot on the middle which may be continued as a vitta to the basal spot. Costal margin pale sanguineous, more broadly so toward the base where it invades the main nervures of the corium, sometimes almost to their apex; apical half of the scutellum with a pale carina continuing the commissural line. Narrow margins of the abdomen whitish.

Described from numerous examples swept from goldenrod at Lakeside, San Diego County, California, October 2, 1913.

This species is very close to *lineola* of which it may be but a geographical race but the black surface is more sericeous, the pale inner and apical margins of the elytra are white, the costa and pale markings of the pronotum are sanguineous and the color on the costa invades the nervures which is not the case in *lineola*. The markings of the pronotum are quite distinct. The pale point on the base of the vertex is very minute but discernable, and there are slender impressed nude lines on the pronotum and on either side of the median carinæ of the scutellum.

58. *Lygaeus bicrucis* Say. Alpine, June 5th, 1913, one example.

59. *Lygaeus lateralis* Dallas. Coronado, June; one example.

60. *Belanochilus numineus* Say. Numbers of larvæ and one adult taken from sycamore balls at Alpine in January, 1914.

61. *Ortholomus longiceps* Stal. July to October; abundant.

62. *Ortholomus arphanoides* Baker. Found commonly on the flower heads of the black sage during May and June.

63. *Ortholomus nevadensis* Baker. Lakeside and Alpine, May and June.

64. *Nysius californicus* Stal. Not uncommon at La Jolla and Torrey Pines from March to July. These are mostly of the dark form erroneously determned as *providus* by Baker. I consider them scarcely worthy of a varietal name.

65. *Nysius strigosus* Uhler. Alpine and Mussey's; June to August.

66. *Nysius ericae* var. *minutus* Uhler. Common everywhere and at all times.

67. *Ischnorhynchus franciscanus* Stal. Common on chaparral from March to October. This is a good species quite distinct from the eastern form.

68. *Arphanus coriacipennis* Stal. Occasional in swampy spots. Abundant at Grossmont along the flume where the leakage supports a rank growth of grasses. May.

69. *Geocoris bullatus* var. *pallens* Stal. Common everywhere in suitable places from March to October.

70. *Geocoris decoratus* var. *solutus* Montd. Taken at Mussey's in August and at Hurlburd's Ranch near Descanso in October. I question the validity of this variety. It is too near *pallens*.

71. *Geocoris punctipes* Say. San Diego, February; one example.

72. *Geocoris howardi* Montd. Not uncommon; March to October. This form is quite variable in color, the elytra becoming at times almost entirely black, the costal margin only pale, and the sides of the pronotum toward the humeri may be broadly pale. Mr. McAtee considers it synonymous with *uliginosus* var. *speculator* but if Mantondon's description can be depended upon it seems sufficiently distinct.

73. *Crophius scabrosus* Uhler. Taken in numbers from a low composite flower growing about the spring house at Buckman's Springs, in October. These Springs are east of the Cuyamaca divide where stragglers from the Arizona fauna might be expected. There were no cedar trees in sight.

74. *Phlegyas annulicrus* Stal. April to June, on dry hillsides.

75. *Heraeus nitens* n. sp.

Larger than *plebejus*, piceous brown, highly polished. Length 7 mm.

Head impunctate, ovate, proportionately larger and more convex than in *plebejus*, longer and more convexly narrowed behind the eyes which are small and placed near the middle of the head; anteocular portion more rounded with the tylus narrow and prominent, exceeding the apex of the cheeks by rather more than its own width; ocelli small, on a line with the hind angle of the eyes separated by more than twice their distance from the eyes. An-

tennæ slender; basal joint exceeding the tip of the tylus by one half its length; much thicker at apex; second joint longest, one and one half times the length of the first; third three fourths the length of the second; fourth nearly as long as the second, fusiform; all the joints but the first minutely hairy. Rostrum reaching to between the intermediate coxæ; first joint surpassing the hind angle of the eye, second attaining the anterior coxæ. Pronotum distinctly shorter than the head and shorter than its basal width; anterior lobe strongly convex, smooth and polished above; posterior as long as the anterior, polished, with coarse distant punctures, the middle line slightly raised and smooth; humeri prominent, smooth and subtuberculate, hind edge straight. Scutellum long and acute at apex, punctate, with a smooth median line on its apical two thirds. Elytra polished, punctate, the claval punctures fewer and less confused than in *plebejus*. Pleural pieces strongly punctured. Anterior femora much incrassated with eight or ten teeth, the middle ones much longer. Venter impunctate, scarcely polished; no lunate vitta.

Color piceous brown becoming almost black on the pronotum, scutellum and pelural pieces; head rufopiceous; elytra verging into fulvopiceous in places, the costal margin narrowly paler, with an indication of the paler square anteapical spot found in *Liggrocoris contractus* and other allied forms. Antennæ, at least the second and third joints, and the legs flavo-piceous, all the femora with a subapical blackish cloud which seems to be wanting on the anterior femora of the male.

Described from one male and two female examples taken at Alpine, March 11th, 1914. These were swept from grass and weeds on the high adobe lands south of the village. I have one larger female that was taken by Prof. J. C. Bradley at Leona Heights, Alameda County, California, in August.

76. *Ligyrocoris nitidulus* Uhler. Alpine and La Jolla, July. I have sent my specimens to Mr. H. G. Barber who is monographing the genus.
77. *Ligyrocoris percultus* Dist. Grossmont, April.
78. *Rhyparochromus sodalicus* Uhler. Found in great numbers on low grasses and weeds at the head of a coast canyon on the Pueblo lands north of the Scripps Institution at La Jolla in March. A few taken at Mussey's in April.
79. *Peritrechus fraternus* Uhler. Coronado, June.
80. *Peritrechus tristis* Van D. Alpine, April; one example.
81. *Sphragisticus nebulosus* Fallen. Occasonal. Comes to lght at night.
82. *Petissius sp.* Alpine, April; one example.
83. *Emblethis vicarius* Horvath. La Jolla, found occasionally running on the paths at Scripps Institution, February to August.

84. *Eremocoris wrighti* n. sp

More slender than our other species; rufo-piceous, antennæ pale at base. Length 6 mm.

Head thorax and scutellum dark castaneous becoming more rufo-piceous beneath and on the elytra. Pronotum oblong, not narrowed anteriorly, the anterior angles depressed and rounded; the carinate margins broad and pale; anterior lobe impunctate; posterior narrow, punctured, paler with two oblique discal vittæ and the slightly elevated humeri blackish, the latter bordered by the foliaceous carinæ. Scutellum small, scarcely punctate. Base of the elytra a little paler, shading darker on the clavus and posteriorly, the dividing line ill-defined and located a little before the tip of the scutellum. Membrane little developed in the type, concolorous. Vertex piceous-black, polished, minutely sericeous. Legs fulvo-testaceous. Anterior femora piceous, apical spur long, posterior wanting, the smaller denticulations scarcely discernable. Posterior femora piceous on their apical half. Antennæ rufo-testaceous; apex of the second joint, all the third and the base of the fourth blackish. Hind tibiæ smooth, the basal joint of its tarsi fully twice the length of the two apical.

Described from one male taken in San Diego city, February 9, 1913, by Mr. W. S. Wright, a student of the Lepidoptera to whom this species is dedicated as a mark of friendship and appreciation of his entomological zeal and every ready assistance in working out the Hemipterous fauna of this county.

85. *Eremocoris inquilinus* n. sp.

A large black species with the clavus, corium and base of the membrane a clear rufous brown. Length 7 mm.

Antennæ and head black, the former touched with pale at the incisures. Pronotum regularly narrowed anteriorly as in *ferus;* anterior lobe dull black, impunctate with the usual median impressed point; collum distinguished by a row of deep punctures; posterior lobe flat, dull black, punctate, the punctures dragged anteriorly and near the middle; slightly tinged with castaneous about the humeri; carinate edges castaneous, but feebly arcuated. Scutellum dull black, punctured, rather deeply impressed and a little wrinkled across the disk. Elytra uniformly rufous-brown, the membrane black except the basal margin and angle. Beneath and legs black, a little shining but scarcely polished; narrow anterior edge of the prosternum, posterior angles of the propleura, hind margin of the metapleura, edges of the coxal cavities, knees, apex of the tarsi, of the rostrum and of the oviduct of the female, tinged with rufous. Anterior femora with about six small teeth, the basal spur much smaller than the apical but distinctly larger than the small denticulations; hind tibiæ smooth except for a very minute pubescence. Mesosternal groove narrower and rather deep.

Described from two male and three female examples taken from nests of the wood rat by Mr. W. S. Wright and the writer on May 10th, 1913, in the canyons east of San Diego city.

86. *Scolopostethus tropicus* Dist. San Diego, Fosters and Grossmont, May.

Family PYRRPOCORIDAE

87. *Largus cinctus* H. S. Not uncommon on bushes and trees. These are darker than the typical *cinctus* and may prove to be *convivus* Stal. The young of this species were described by Kirkaldy as the young of *Stiretrus anchorago*, a Pentatomid!

Family TINGIDIDAE

88. *Piesma cinerea* Say. May to August; not uncommon. Sometimes of a greenish white color but such paling is quite characteristic of the arid regions.

89. *Corythucha fuscigera* Stal. San Diego, May; on chaparral.

90. *Corythucha marmorata* Uhler. Alpine, October; on a wild sunflower, perhaps a Hieracium. Also taken in June. A third species of this genus inhabits the mountain balm and a fourth the Heteromeles but I have not had time to work these out.

91. *Gargaphia opacula* Uhler. Lakeside and Mussey's, August to October. Abundant on willows along the river.

92. *Physatochila plexa* Say. Lakeside, October; one example.

93. *Teleonemia nigrina* Champ. April to October; common on a yellow flowered Leguminose plant allied to alfalfa, also found on Rhus laurina.

Family PHYMATIDAE

94. *Phymata erosa parva* Handl. Common on Eriogonum and other flowers. As I determine this subspecies it is a small strongly marked form with the sides of the pronotum but little emarginate and the humeral angles more rounded, not strongly prominent.

95. *Phymata erosa severini* Handl. Common. June to October. This is a small form like the preceding but the humeral teeth are more prominent with the pronotal sides more deeply notched. The colors are paler in this form but the males are clearly marked with a black band across the abdomen, another across the humeri and a dot on the margins of the pronotum anterior to the sinus. It is our most common form.

96. *Phymata erosa arctostaphylae* n. subsp.

Very close to *fasciata* Gray, a little larger, sides of the abdomen more strongly angled, the humeri more produced, almost alate, the anterior teeth much more prominent than the posterior; the submarginal posterior carina distinct; apical lobes of the head longer and more pointed. Color dark mahogany brown with indications of the transverse black bands across the broadest part of the tergum and on the hind margin of the pronotum; beneath clear red, almost sanguineous. Length 9 mm. greatest breadth of the abdomen 5 mm.

Characterized from a single female beaten from a bush of the broad-leaved mountain Arctostaphylos, or manzanita, near Morena

Dam in October 1913. The most interesting character of this insect is its remarkable color adaption, harmonizing exactly with that of the bark on which it rests.

97. *Macrocephalus cimicoides* Swed. Alpine, June; one example taken on the dry granite hill sides.

Family REDUVIIDAE

98. *Ploiariola californica* Baker. San Diego and Coronado, June and July.

99. *Ploaria californiensis* Baker. Mussey's, August; one example.

100. *Oncocephalus nubilus* n. sp.

Most nearly allied to *cinctiventris* Reut. from Africa. Basal joint of the antennæ bald above; testaceous with a dorsal fuscous cloud. Length 18 mm.

Head normal, unarmed beneath; anteocular portion equal to the postocular and eyes together; post-ocular portion gibbous and abruptly narrowed behind, strongly elevated about the ocelli; armed beneath on either side behind the eyes with three porrect stiff bristles and there are about three on the tubercular antennal sockets. Basal joint of the antennæ thickened toward the apex, bald above, below and on either side armed with long stiff bristle-like hairs as is the entire second joint, these becoming shorter toward the apex; second joint one half longer than the first; third shorter than the first. Rostrum with the first joint sub-equal to the second, the apical only fuscous. Pronotum unarmed on the disk and humeri, the anterior angles with a blunt tubercle; disk with the two median carinæ distinct, the humeri prominent, sharply right-angled; sides obtusely carinate; prosternal tubercles short and blunt. Scutellar spine long as in *geniculatus* and the characters of the legs and elytra as in that species.

Color pale testaceous; a broad dorsal fuscous cloud is narrowed to a point at the anterior margin of the pronotum and is deepened almost to black on the posterior disk of the pronotum, covers the scutellum except the pale apical spine and its basal carina, and is dispersed over the elytra where it omits the broad base of the costa and becomes obscurely dotted with pale posteriorly. Eyes, tumid base of the head, its lower surface and a line behind the antennæ, black. Antennæ infuscated with the incisures and hairs paler. Legs marked as in *geniculatus;* femora fuscous at apex, the posterior with a broad median annulus; tibiæ with the base and apex and a median annulus fuscous, the annulus on the posterior displaced to near the base. Margins of the connexivum with a black line near the base of each segment.

Described from a single male taken by Prof. F. H. Snow on the San Bernardino Ranch, Cochise County, Arizona in August, at an altitude of 3750 feet. What I believe to be the immature female of this species occurred in numbers with its dark fuscous larvæ all over, with the dorsal fuscous cloud less defined, and the elytra nymphs differ in being darker and more or less clouded with brown under stones on the adobe lands at Alpine, April 22, 1913. These

which just pass the middle of the tergum, infuscated and pale-irrorate, the antennæ want the long hairs.

101. *Conorhinus protractus* Uhler. Common in nests of the wood rat.

102. *Rasahus thoracicus* Stal. Common in houses about lights from July to October. It bites severely when carelessly handled. I can see no object in uniting this form with *biguttatus* Say.

103. *Apiomerus crassipes* Fabr. Common everywhere on flowers from May to October. As found here this species is black with the anterior coxæ femora below and sometimes a subapical annulus, an annulus near the base of the anterior tibiæ and the base of the costa sanguineous; connexivum and hind margin of the pronotum narrowly pale. The species shows little tendency to variation here.

104. *Diplocodus exsanguis* Stal. Alpine, October. There is no occasion for uniting this with *luridus* Stal.

105. *Pindus socius* Uhler. Common from March to October.

106. *Rhynocoris ventralis* var. *femorâlis* n. var.

This variety differs from the typical *ventralis* in being soiled testaceous where that is red, although it may become fulvous on the legs and antennæ or even tinged with sanguineous. The antennæ are of an obscure testaceous; the legs are black with a quadrate spot on the lower surface of the femora, and the tibæ except at base, pallid. The coriaceous portion of the corium is a clear testaceous.

Described from three females taken on the dry granite hillsides at Lakeside in May and at Alpine in June.

Variety *americanus* Bergr. is very close to the typical *ventralis* but has the red a little more extended. Another variety from Felton, California, in my collection is very near *femoralis* having the same testaceous color but in this the anterior lobe of the pronotum and the legs are soiled testaceous, the latter with the apex of the femora, the base and apex of the tibiæ and a subapical annulus on the hind femora black. The single female specimen was taken by Dr. J. C. Bradley in the foot hills of the Santa Cruz mountains in March 1907. It may be called (107) var. *annulipes*. The typical *centralis* seems to be more common in Colorado and Utah although I have one example taken at Pasadena, California, by Mr. Fordyce Grinnell in July.

108. *Pselliopus spinicollis* Champ. Taken frequently on a low bush which has a remarkably strong sickening odor, from March to August. I have been unable to determine this shrub which rarely grows more than two feet in height. It has much the aspect of a Solanum but may be more nearly allied to Arctostaphylus. The leaves are small and linear.

109. *Heza similis* Stal. One example taken June 18th, 1913, from a live oak tree in the Sweetwater Valley. It has not before been recorded from our territory.

110. *Acholla tabida* Stal. Coronado, June.

111. *Sinea diadema* Fabr. July to October; common.

112. *Sinea complexa* Caud. Alpine and El Cajon, April and May. Apparently rare.

113. *Sinea rileyi* Montd. Common from March to October, generally of a dark chestnut brown color.

Family NABIDAE

114. *Nabis (Hoplistoscelis) crassipes* Reut. Lakeside and Lemon Grove. May and June, brachypterous form only.

115. *Nabis (Nabis) ferus* Linn. Common throughout the year especially in alfalfa fields.

Family ANTHOCORIDAE

116. *Piezostethus flaccidus* n. sp.

Near *cursitans* but larger and with the elytra almost entirely pale. Length 2½ mm.

Head black, polished. Antennæ black, the apical two joints a little paler, third and fourth joints subequal, each shorter than the second. Rostrum attaining the intermediate coxæ, testaceous. Pronotum black, impunctate; anterior lobe polished, posterior transversely rastrate on the disk, the hind margin but feebly arcuated. Scutellum polished, impunctate. Elytra impunctate, entirely polished, pale soiled testaceous, a little darkened on the clavus and cuneus; the tip of the clavus, hind margin of the cuneus and its exterior nervure embrowned; cuneus otherwise concolorous. Membrane clear hyaline, immaculate. Beneath deep black, mostly polished, the female ovipositor only ferruginous. Osteolar canal long, distinct, broadly curved at apex and ending abruptly just before the anterior margin of the metapleura. Femora black, tibiæ and tarsi brownish-testaceous.

One brachypterous example evidently belonging here has the female ovipositor black and the elytra testaceous, reaching on to the second segment of the tergum with the clavus and cuneus black.

Described from one macropterous female taken at Hurlburds Ranch near Descanso on October 16, 1913, and one brachypterous female captured at Alpine, June 20, 1913.

117. *Anthocoris antevolans* White. Lakeside, May; one example.

118. *Anthocoris ornatus* n. sp.

Structurally nearest *gallarum-ulmi* of Europe; black, elytra before the cuneus and the legs a rich chocolate brown; membrane black with a large white spot on either side. Length 3½ mm.

Head rufo-piceous shading to black above between the eyes. Antennæ rufous with the first joint and apex of the second and third black. Rostrum black attaining the anterior coxæ. Pronotum rufous or rufo-piceous becoming black on the disk above; surface transversely rastrate excepting for some smooth areas on the anterior lobe; hind margin transversely excavated, scarcely arcuated. Scutellum rastrate. Elytra impunctate; em-

bolium, cuneus and apex of the corium beyond the tip of the clavus polished, the rest of the corium and the clavus opake; clavus, embolium and opake portion of the corium chocolate or rufus-brown; cuneus and apex of the corium black. Membrane black with a broad transverse white vitta at the apex of the cuneus, interrupted in the middle. Beneath black, the disk of the ventral segments rastrate; propleura and legs rufous. Osteolar canal distinctly elevated, the apex a little bent forward.

Described from two females taken at an altitude of about 5000 feet in the Cuyamacas in October 1913. Two damaged specimens that seem to belong here were taken by Dr. J. C. Bradley at Felton, Calif., in September and at Sisson, Calif., in August, 1908. This pretty species runs to "11" in Reuter's key.

119. *Triphleps tristicolor* White. April to August; not uncommon.

120. *Scoloposcelis discalis* n. sp.

Closely allied to *flavicornis* Reut. but shorter and broader with the disk of the elytra conspicuously white. Length 2¼ mm.

Black. Head and pronotum polished, the posterior disk of the latter a little transversely depressed and roughened. Antennæ testaceous brown, basal joint black, reaching the apex of the head; second stout, clavate, as long as the width of the head across the eyes; third and fourth very slender, subequal, together hardly longer than the second. Rostrum pale, attaining the anterior coxæ. Scutellum black, polished on the base, transversely depressed before the apex. Elytra white, when closed showing the hylaline colors of the wings beneath; scutellar and commissural margins of the clavus, embolium and cuneus black. Membrane hyaline white. Beneath and legs black, the tibiæ, tarsi and oviduct of the female flavo-testaceous. Osteolar canal long, subangularly curved at about its middle, its acute apex almost reaching the anterior angles of the metapleura.

Described from 1 female and five males taken from under the loose bark of a rotting cottonwood log at Lakeside, October 2, 1913. This species is near *flavicornis* but its broader form, shorter second joint of the antennæ and its smaller size will distinguish it. The inner angle of the cuneus is entirely black in this species.

Family CAPSIDAE

121. *Phytocoris rau* Van D. Taken occasionally on Adenostoma from May to July but it does not seem to be common here. It is a pretty green insect with black clavus and dark castaneous legs and antennæ.

122. *Phytocoris rufoscriptus n. sp*

Form and aspect of *puella* but much larger; soiled whitish-yellow, the elytra and hind femora quite uniformly inscribed with sanguineous. Length 7 mm.

Head produced as in *cunealis*. First joint of the antennæ linear, not thickened toward the base as in *puella*, clothed with white hairs which are distinctly longer than the thickness of the joint.

Elytra almost parallel, a little widened apically. Hind femora just about attaining the apex of the membrane. Wall of the sinsitral notch of the male genital segment vertical and produced above in a prominent tooth directed backward thus giving the notch an almost circular outline.

Color pale straw yellow more or less obscured in places. Head marked with two spots on the base of the vertex between the eyes and two on either side beneath pale sanguineous. Pronotum with the collum and some marks behind it pale sanguineous, the hind submargin with a line of black points, more or less confluent, which probably carry black hairs when freshly excluded. Scutellum clouded with fulvous on the disk on either side. Elytra including the cuneus quite uniformly inscribed with sanguineous with some darker flecks along the costa and a conspicuous black point at the inner angle of the cuneus. Membrane fuscous, uniformly irrorated with pale and with two larger pale spots beyond the tip of the cuneus, the nervures mostly sanguineous. Sternum smooth and blackish between the anterior and intermediate coxæ; hind femora with sanguineous irrorations on the apical two-thirds which become darker and segregated into about three incomplete transverse vittæ beneath; hairs on the hind femora and tibiæ long and black. Abdomen dusky in places, especially on the venter and base of the genital segment.

Described from five males and one female, taken near Alpine Heights, June 8th, 1913, and Mussey's, April 13th, 1913. Also taken at Alpine in June, 1914. This species bears the same relation to *puella* that *cuncalis* does to *infuscata*.

123 *Phytocoris cuncalis* n. sp.

Form and aspect of *infuscata* but much larger; rufous-brown and straw-yellow shaded with sanguineous, base of the cuneus clear yellow its apex sanguineous. Length about 7 mm.

Head viewed from before conspicuously larger than in *infuscata*, the eyes occupying scarcely more than one half its length; pronotum a little longer; elytra proportionately broader and more widened apically; hind femora distinctly longer, a little surpassing the apex of the elytra. Basal joint of the antennæ linear, not thicker at base than at apex as in *infuscata* and longer in proportion to the second joint. Wall of the sinistral notch of the male genital segment vertical and distinctly thickened, with a prominent rounded tubercle above. In *infuscata* this wall is a little oblique and rounded off above without a tubercle, while in *puella* and its variety *confluens* this wall is cut off obliquely nearly from its base.

Color when mature a rufous-brown, more or less tinged with straw-yellow and becoming sanguineous in places; antennæ, rostrum, legs including the acetabulæ, nearly white. Head and scutellum pale yellow, the former clouded with sanguineous on the sides and more faintly above, the base pale, the latter marked with fulvous on either side toward the apex, the basal lobe beneath the pronotum dark reddish brown. Antennæ becoming infuscated on the apical joint; basal joint with long pale hairs. Pronotum some

shade of rufous-brown becoming pale yellow behind the vertex and marked with a fuscous line before the hind margin; this margin with a line of silvery scales which may be continued well around the humeri. Elytra obscure brown on the basal half, sometimes washed with pale along the claval suture and more or less distinctly irrorated; this brown area darkened behind where it is cut off obliquely to the apex of the scutellum and is followed by a whitish area, the apical half of the corium paler and more obviously irrorate with sanguineous and flecked with whitish on the costal and apical margins; basal half of the cuneus lemon yellow, the apical half sanguineous; tip of the clavus and two points on the margin next the membrane fuscous. Membrane infuscated, quite evenly irrorate with white and with two larger white spots beyond the tip of the cuneus, the nervures largely sanguineous. Sternum darker between the anterior and intermediate coxæ. Venter dull sanguineous becoming yellow toward the apex and a little infuscated on the venter in the female. Hind femora dark sanguineous, paler at base; apex more or less distinctly irrorate; hind tibiæ with a broad fuscous annulus near its base.

Described from numerous examples taken on oak bushes at all places where I have collected, April to June. When immature the colors are paler but the pattern of marking which is much like that of *infuscata* is always distinct. I consider Reuter's var. *infuscata* of *puella* a distinct species as it is constant in its characters and the form of the male genital segment is characteristic and distinctive, while *puella* and its other variety *confluens* are similar.

124. *Phytocoris eximius* Reut. A form that seems to belong here is fairly common from April to October. A number of other closely allied forms also occur here which I have not had the time to work out.

125. *Phytocoris jucundus* n. sp.

Aspect of *cunealis* but smaller and more rufous, larger than *infuscata*. Length about 8 mm.

Head of the same form as in *infuscata*, whitish with rufous irrorations which are few on the disk of the vertex. Basal joint of the antennæ proportionately shorter and thicker than in *infuscata*, as long as the pronotum and head to the base of the antennæ, a little thicker toward its base; armed with a few stout bristles; dark rufous irrorate with paler; second join nearly three times the length of the first, linear, infuscated, with a broad pale medium annulus and a narrow one on the base; third and fourth together more slender and about as long as the second, the apical blackish. Rostrum just passing the hind coxæ, pale, becoming black at apex. Pronotum as in *infuscata;* dull rufous, paler on the disk; slender hind edge pale, set off by a row of black scales; surface clothed with soft pale hairs and deciduous black bristles. Scutellum a little more convex and polished than in *cunealis*, rufous with a pale tip. Elytra as in *infuscata*, obscure rufous with the base and a transverse vitta pale, the latter but very little oblique and indefinite posteriorly, the suture of the cuneus also pale, the

rest of the cuneus clear rufous with two black points on the inner edge. Membrane infuscated, variously irrorated with pale or at times mostly hyaline, the nervures red. Beneath and legs rufous, paler on the coxal region and base of the femora; tibiæ with three pale annuli; the posterior pair pale with two broad fuscous bands; femora, especially the posterior, irrorate with dark rufous, with a few scattering dark bristles. The whole upper surface is clothed in places with deciduous white scale-like hairs when fresh.

Described from numerous examples beaten from pine trees at Pine Hills in the Cuyamaca Mts. at an altitude of 4200 feet, Oct. 19th, 1913. This species has much the pattern of marking found in *cuneatis* but the medium pale elytral band is much less oblique than in that species.

126. *Phytocoris reuteri* n. sp.

Form and aspect or *roseus* Uhler nearly, but of a testaceous-yellow color; slender, the elytra long and parallel marked with fuscous. Length 6-7 mm.

Head long, almost vertical; tylus prominent, convex; vertex obsoletely striate, as wide as the eyes in the male, wider in the female. Pronotum long, strongly narrowed anteriorly. Elytra much longer than the abdomen in both sexes, linear in the male, wider and a little flaring in the female. Rostrum attaining the fourth abdominal segment. Antennæ long and slender, formed as in *roseus;* basal joint nearly linear, as long as the head and pronotum together; second about one third longer than the first; third and fourth together about equal to the second. Apex of the genital segment of the male acutely triangular; dextral notch very shallow, sinistral deep and broadly and obtusely triangular.

Color pale straw-yellow tinged with green on the pronotum and with testaceous on the elytra. Head with two fuscous spots behind the eyes and a faint one on the lorœ sometimes wanting, those behind the eye extended a little way on the sides of the pronotum; hind edge of the pronotum narrowly white, on the middle bounded before by a double black arc which may become continuous or broken into dots. Scutellum black on the basal middle and with a black mark on the disk either side, which may be wanting; costal edge of the corium alternated with fuscous and white, a blackish streak along the center of the clavus and two on the corium following the principal veins, those of the corium sometimes widened into a fuscous or black cloud covering the inner apical angle; apical margin of the corium and cuneus alternated with black and white and there is a black point at the tip of the corium; cuneus sometimes tinged with pink. Membrane fuscous becoming black on the apical half, basally more or less irrorate with white, the outer border marked with two conspicuous white spots beyond the point of the cuneus, nervures pale, sometimes pink; in some individuals the membrane is largely whitish hyaline. Antennæ blackish; first joint fuscous dotted with white; second with a narrow white annulus at base and a broader one on the middle which is sometimes obscure; third joint very

carinate margins broad and pale; anterior lobe impuctate; posterior narrow, punctured, paler with two oblique discal vittæ and the narrowly white at base. Femora irrorate with brown, the posterior darker toward the apex and marked with a pale annulus on the apical fourth, tibiæ trianulate with fuscous, their apex and the tarsi black, the markings on the hind tibiæ obscure. Abdomen a little embrowned in the female or at times greenish.

Described from numerous examples taken on a ragged looking weed growing at Alpine and elsewhere among the hills, July. The colors of this insect harmonize very well with the flower and fruit clusters over which it roams, making it difficult of detection. When taken in the net it is very active and difficult to capture.

127. *Phytocoris roseus* Uhler. This graceful pretty species is occasionally taken on Eriogonum in June and July.

128. *Phytocoris canescens* Reut. Abundant everywhere on sagebrush in both the long and short winged forms through the entire year. The brachypterous form has a black cuneate mark on the elytra.

129. *Creontiades rubrinerve* Stal. San Diego, July; on Ambrosia.

130. *Creontiades femoralis* n. sp.

Larger and stouter than *rubrinerve,* more or less marked with rufous; Femora mostly fuscous or almost black. Length 7 mm.

Head convex above, the surface distinctly striate and the median sulcus conspicuous, yellowish-testaceous, irrorate with rufous. Basal joint of the antennæ shorter and much stouter than in *rubrinerve,* subfusiform, irrorate with sanguineous and armed with a few black bristles; second and third subequal in length and linear, each about twice the length of the first, obscure rufous; fourth paler, slender, nearly as long as the first. Rostrum reaching to the hind coxæ, pale, black at tip. Pronotum broader at apex than in *rubrinerve;* pallid with an obscure fuscous cloud along the hind margin before the scutellum and there may be a few fuscous dots scattered about the anterior and lateral surfaces. Scutellum pale, the extreme tip black, the base with a fuscous cloud bisected by a pale median vitta, about the disk are a few fuscous points. Elytra pallid, quite regularly dotted with minute fuscous points and marked with sanguineous along the costa and on the margins of the cuneus. Membrane pallid, the nervures concolorous. Beneath more or less marked with rufous; the femora and tibiæ in part minutely dotted with sanguineous, the posterior femora deepened to piceous black beyond the middle.

Described from two females taken at Pine Hills in October. The more convex vertex, thicker basal joint of the antennæ, pale testaceous color, the fuscous cloud on the base of the pronotum and scutellum and the piceous hind femora will distinguish this species. It has the broader form of *Eustictus* but wants the polished punctured surface of that genus.

131. *Poecilocapsus nigriger* Stal. Taken in numbers on the white sage at Mussey's in April; occasional elsewhere.

132. *Lygus pratensis* Linn. One form of this species very like the typical *lineolatus* P. B. is found abundantly about cultivated fields, especially alfalfa, throughout the year.

133. *Lygus pratensis* var. *elisus* n. var.

This is a smaller form often taken in great numbers on Chenopodium. It is pale greenish with the pronotum and scutellum of a clearer green; head and anterior margin of the pronotum yellowish, neck when depressed showing a black line. Pronotum with two round black dots placed just behind the callosities and sometimes a few brown points before them. Scutellum usually showing two mediam basal dashes and the extreme lateral angles black. Elytra pallid with a dusky cloud on the middle of the clavus and a double one on the disk of the corium posteriorly, all of which may be reduced or wanting; there is a minute brown point at the tip of the clavus and another at the apex of the cuneus. Legs paler than in the typical form but with the same pattern of marking. Length 5-6 mm.

Described from numerous specimens taken at Mussey's August 6th, 1913, and elsewhere.

134. *Lygus contaminatus* Fallen. Not uncommon, May to October. This is quite distinct from the eastern *pabulinus;* it varies some in the amount of the dark clouding on the elytra.

135. *Lygus sallei* Stal. Occasional, April to June. The brilliant sub-metallic polish of this species with the slender black and white lines on the hind margin of the pronotum will distinguish it.

136. *Lygus rubicundus* Fallen. Two uniformly rufous examples were taken at Mussey's in May, 1914.

137. *Lygus distinguendus* Reut. I have a single specimen from the Selkirk Mts., B. C., that seems to be variety B of Reuter (Hemip. Gymn. Eur. V, p. 74, 1896). The variety described below is apparently constant and may prove to be a distinct species.

138. *Lygus distinguendus* var. *nubilus* n. var.

Form of *rubicundus* Fall.; yellowish-testaceous mottled and clouded with fuscous or black. Head with a dot on the cheeks before the base of the antennæ and unusally about four spots on the vertex forming a square. Antennæ pale, the third and fourth joints and usually the apex of the second infuscated. Pronotum in fully colored examples with fuscous markings as follows: a spot on the anterior margin behind the eye, another behind each callosity which may be enlarged and form a cloud on the anterior disk, a point near the middle of each lateral margin, and four on the hind edge which may unite and form a transverse vitta. In pale examples most of these markings are reduced or absent but the two spots behind the callosities and those on the humeri persist. Scutellum black with the basal angles and median line pale, the extreme tip white. Brown markings on the elytra usually forming

two transverse bands, one at apex and the other beyond the tip of the scutellum; the inner margin of the clavus is often brown and the pale areas are dotted with brown; the whole surface varied with groups of white hairs. Cuneus pale with the inner angle fuscous and the extreme tip castaneous-brown. Membrane blackish with the base, a marginal spot at the apex of the cuneus and a fainter one on the disk whitish. Beneath the sternum and meso- and meta-pleura are marked with black and there are about three black dots on the propleura. Legs pale, normally with two or three fuscous bands. Length 4 mm.

Described from numerous examples taken on elderberry trees growing along the streams and gullies throughout the county. This tree or shrub has a powerful and exceedingly disagreeable and suffocating odor which is not alluded to in any botanical work on this region to which I have access.

139. *Camptobrochis fulvescens* Reut. Alpine, two examples taken in June. This seems to be our only representative of the subgenus *Euarmosus* in which the body is more flattened above and the embolium is continued distinct as far as the cuneus.

140. *Camptobrochis schwarzi* Uhler. This species is abundant on the chaparral from May to July and is subject to great variation in color. Some are nearly as pale as *fulvescens* while others are almost entirely black above, with the head, collum and cuneus only rufous; beneath the body and legs are mostly rufous; antennæ pale rufous with the thickened apex of the second joint black. In this species the sides of the pronotum are straight or almost sinuated, nearly to the apex and are punctured close to the edge without the smooth carina found in *cerachates* and *fulgidus;* from the latter it also differs by the colored antennæ and legs, black scutellum and rufous cuneus.

141. *Camptobrochis fulgidus* n. sp.

Deep shining black; head rufo-testaceous, scutellum sanguineous. Length 5 mm.

Form of *schwarzi;* broad oval, convex. Head as in the allied species, polished, rufo-testaceous; tip of the clypeus and a line below the antennæ dusky. Antennæ entirely black. Rostrum blackish. Pronotum unusually convex and with the elytra polished and coarsely punctured; callosities prominent, polished, confluent; sides distinctly regularly arcuated, the extreme edge carinate and impunctate. Scutellum polished, impunctate, sanguineous or sometimes dusky on the extreme base, strongly convex as in *schwarzi.* Membrane black, minutely corrugated but smooth in the areoles. Beneath the legs black.

Described from numerous examples taken about San Diego and as far east as Alpine, March to June. I also have one specimen taken by Mr. Fordyce Grinnell at Pasadena and I took another at Fort Collins, Colo., in July, 1900. This species has much the color of *sayi* but pertains to a different section of the genus distin-

guished by the more convex form and by having the embolium merged with the corium beyond the middle, the present species lives on Ceonothus.

142. *Camptobrochis validus* Reut. Torrey Pines, from elder trees growing near the foot of the grade, June 21, 1914. This species is exceedingly variable in color and I possess specimens that are almost entirely black. Those from Torrey Pines have the antennæ entirely black and the head mostly so; the scutellum margined with pale.

143. *Camptobrochis phorodendronae* n. sp.

Nearest *schwarzi* but very distinct from any described species; small, broad ovate, very convex; elytra impunctate, bullate, abruptly deflexed behind. Length 3 mm.

Head almost vertical, transverse; vertex convex, polished as in the allied species; clypeus and cheeks together abruptly produced from the transverse front line of the face, basal sulcus of the vertex if present obscured by the markings, certainly absent at the middle. Antennæ proportionately shorter than in *schwarzi;* basal joint very short, hardly attaining the apex of the clypeus; second about as long as the pronotum, moderately clavate; third and fourth shorter, together about two thirds the length of the second; the fourth much shorter than the third. Eyes very large and prominent. Rostrum attaining the intermediate coxæ, the first joint scarcely surpassing the anterior line of the eyes. Pronotum short, strongly convex and rounded, polished, coarsely punctured, callosities prominent, not attaining the lateral margins, resting on the very pronounced collum; sides moderately arcuated; hind margin strongly rounded; middle line smooth as are also the narrow lateral and posterior margins. Scutellum strongly convex, impunctate, polished as in *schwarzi.* Elytra broad, a little bullate posteriorly, highly polished, impunctate except for a single line on the claval suture; embolium narrow, scarcely widened at base or connivent with the corium beyond the middle; cuneus small, polished and with the membrane almost vertical, the latter with one strong nervure only. Legs normal, smooth.

Color pale testaceous becoming almost white on the scutellum across the bullate disk of the elytra and on the legs. Vertex circumscribed by brown and with a transverse line posteriorly, margins outside the annulus and the clypeus yellowish-white, the clypeus edged with black. Apex of the second antennal joint broadly black; two thirds of the third and all but the narrow base of the fourth brown. Rostrum pale, the basal joint and adjoining surface darker. Pronotum with a lateral line, two oblique marks on the disk and two large spots on the base blackish; collum yellowish-white, lined behind with black. Scutellum with the tip and three more or less obvious basal clouds infuscated. Elytra pale brownish, the bullate posterior disk transversely whitish; all the margins of the clavus and the costal and subcostal nervures black; cuneus castaneous-brown. Membrane brownish hyaline, darker across the disk, the nervure lined with black. Beneath black; the

propleura and most of the venter pale, the basal disk of the latter and the genital segment largely black. Femora with a dusky subapical annulus.

Described from four female examples taken on the oak mistletoe, Phorodendron villosum, growing on oaks at Pine Hill in October, 1913. The bullate impunctate elytra and transverse head would almost seem to warrant the erection of a new genus for this species but it is no more distinct from *Camptobrochis* than are some of the other genera Dr. Reuter has sunk as synonyms and it seems best for the present to place it as a section of that genus. I have been unable to make out the areolæ. The depth of coloring is undoubtedly subject to variation.

144. *Peociloscytus uhleri* n. n. (P. *intermedius* Uhler, Proc. Calif. Acad. Sci., Ser. IV, p. 261, 1891; not of Jakowl., 1876.) The species I am identifying as *intermedius* Uhler is very abundant through the spring. It differs from Uhler's description in many points, but I cannot believe it distinct. It is larger and more fulvous in color than *basalis* with the basal joint of the antennæ pale, the femora darker toward their apex but not distinctly annulated, the vertex is more convex and wants the striæ and the male genital characters are appreciably different. It is extremely variable in color as is *basalis*, some individuals being largely black above.

[A recent comparison with the Uhler type now in the collection of the California Academy of Science shows this determination to be correct.]

145. *Poeciloscytus elegans* Reut. I have taken this pretty little Capsid on a species of Galium which grows on the dry, rocky hillsides in the back country, May and June.

Genus Pycnocoris n. gen.

Evidently allied to *Poeciloscytus* but with somewhat the aspect of a heavy *Neurocolpus*. Distinguished by the rough opake surface of the body, the short, greatly thickened first two antennal joints, the short and abruptly slender apical joints and the tumid scutellum. Whole surface clothed with short whitish scale-like hairs intermixed above with short black bristles.

Form stout, broadly ovate-oblong. Head nearly vertical but less so than in *Neurocolpus* and broader when viewed from above. Base of the vertex without a carina; clypeus arcuated and prominent. Antennæ short and thick; first joint as long as the width of the vertex and one eye, stout and cylindrical nearly to its base; second twice the length of the first, clavate, the apical two fifths nearly as thick as the first joint; third and fourth abruptly slender, together not as long as the first, fourth two thirds the length of the third. Pronotum transverse, sloping strongly to the head, sides nearly straight, collum slender, callosities poorly defined, hind margin nearly rectilinear across the scutellum. Disk of the scutellum strongly tumid. Elytra broad, almost parallel, the costa slightly expanded near the base, surface rough but scarcely punctate. Membrane a little surpassing the tip of the abdomen. Ros-

trum attaining the apex of the intermediate coxæ, the basal joint clavate, reaching over to the base of the anterior coxæ. Basal joint of the hind tarsi a little longer than the second; arolia free, divergent.

Type *Pycnocoris ursinus* n. sp.

146. *Pycnocoris ursinus* n. sp.

Color testaceous brown, becoming testaceous on the cuneus, abdomen and legs, the corium crossed by two broad fuscous bands, one just beyond the scutellum and the other at the apex, the former often obsolete. Head tinged with rufous in the region of the tylus, Antennæ closely clothed with short stiff hairs which become whitish on the apical two joints; dark rufous brown becoming clear rufous on the basal two thirds of the second joint, the basal one half of the third joint whitish. Rostrum pale reddish becoming black at apex. Pronotum very uniform in color, a little darker toward the base and castaneous anteriorly. Scutellum darker on the tumid portion. Elytra with the costal area pale testaceous, the whitish hairs becoming golden on the dark areas as they are on the dark tumid portion of the scutellum. Cuneus rufous or sometimes yellowish on the disk, the tip darker or sanguineous, the basal angle infuscated. Membrane infuscated, marked with a large whitish spot at the tip of the cuneus which may be extended to an incomplete transverse vitta, nervures dark sanguineous. Beneath more or less sanguineous becoming yellowish on and near the coxæ and at times on the venter. Meso- and Meta-pleura blackish. Legs rufo-testaceous, especially on the femora which are dotted with sanguineous, tips of the tarsi infuscated. Length 6-7 mm.

Described from eight female examples taken from the chaparral at La Jolla, San Diego and Alpine during March and April. When immature the insect is more greyish with the cuneus pale. This large heavily built insect is very different from anything known to me nor can I find any genus that will receive it. At first look it would almost certainly be placed near *Neurocolpus* but its true affinities seem to be with *Poeciloscytus*.

147. *Irbisia pacifica* Uhler. Not uncommon in damp situations on tall grass. May.

148. *Irbisia brachycerus* Uhler. This is perhaps the most abundant Capsid in cultivated districts in southern California. I found it common in Colorado and also have specimens from Utah and New Mexico. The legs are ordinarily rufo-fulvous but in some I cannot otherwise distinguish they are black. The legs are wanting in Dr. Uhler's type so we cannot tell which form is the typical one but it seems to me we might be justified in assuming that it was the more common red-legged form that he had before him. If we do this we can place Heidemann's *Capsus solani*, which does not seem to differ specifically, as the black legged form and as variety *solani* it would be equivalent to var. *tyrannus* Fabr. of *Capsus ater Linn.*

149. *Platytylellus basirittis* Stal. Occasional, April to July. I have taken some color varieties which probably are not distinct from this species.

150. *Stenodema gracilis* n. sp.

Aspect of *vicina* but more slender with the antennæ black or nearly so. Length 7-8 mm.

Head a little more produced before the antennæ than in *vicina*, the median sulcus distinct; Antennæ longer, first joint thinner and distinctly longer than in that species, as long as the pronotum. Rostrum attaining the hind coxæ, the first joint just reaching the base of the head. Pronotum narrower and more convex than in the allied species, coarsely punctured, the median smooth line nearly obsolete; sides sharply carinate, narrowly foliaceous. Basal lobe of the scutellum a little exposed, disk of posterior lobe obscurely transversely punctate or rugose. Elytra slender, parallel, punctured except on the broad costal area and cuneus. Legs shorter and more slender than in *vicina*.

Color: Female, yellowish-testaceous. Antennæ dark castaneous or piceous black; a broad black vitta covers the sides of the head including the base of the antennæ and the eyes, crosses the pronotum and covers the basal angles of the scutellum. Elytra dusky brownish with the smooth costal margin and cuneus pale. Beneath and legs pale with indications of a longitudinal vitta across the pleural pieces and sides of the abdomen; tip of the rostrum and tarsi black; femora not dotted. The basal joint of the antennæ is paler beneath and the middle line of the rostrum is dark.

In the male the black vittæ above and below are much extended, covering most of the surface; above omitting a nearly parallel yellowish median vitta to the apex of the scutellum, and the expanded sides of the pronotum and elytra; the disk of the elytra is dark brown, more blackish on the scutellum. Antennæ black; rostrum as in the female; the femora a little darker.

Described from numerous specimens of both sexes taken at San Diego, Lakeside and Mussey's during April and May. From Carberry in Canada I have received a pale example of what is probably this same species, showing a wide range to the north. Although the base of the scutellum is narrowly exposed the base of the pronotum is truncate and the species evidently belongs to *Stenodema*.

151. *Trigonotylus breviceps* Jakw. This species which I believe I have rightly identified is common on a low fine grass growing in moist locations at most places where I have collected in this county. It is found throughout the year.

152. *Dicyphus californicus* Stal. April and May. Common.

153. *Dicyphus vestitus* Uhler. Occasional in the back country from April to June. I have taken few individuals of this species that are as dark as indicated by Dr. Uhler.

154. *Dicyphus minutus* Uhler. April, a few only.

155. *Paraproba pendula* n. sp.

Allied to *fasciata* Dist. but evidently distinct. Whitish; head

and antennæ mostly, pronotum laterally, and the scutellum black; closed elytra with a pendulum-like fuscous mark touching the base of the membrane. Length to tip of the elytra 3 mm.

Head viewed from above transversely oval; vertex convex, almost vertical before; clypeus triangularly produced; surface polished, impunctate, behind the eyes abruptly narrowed, leaving the eyes distinct from the pronotum. First joint of the antennæ nearly as long as the width of the head across the eyes; second linear, two and a half times the length of the first and a little more slender; third and fourth together a little longer than the second, much thinner. Rostrum attaining the intermediate coxæ. Pronotum trapezoidal, its sides straight, the base nearly so; collum wanting; callosities distinct; surface smooth, impunctate. Basal lobe of the scutellum well exposed. Elytra long and parallel, subhyaline. Legs long and slender; tibiæ smooth. Basal joint of tarsi apparently shorter than the second. Areole of the wing without a hamus. I am unable to detect the arolia.

Color pale yellowish-white, often strongly tinged with bluish-green on the elytra. Head black, the base behind the eyes ochraceous and the gula fuscous. Antennæ black, the base of the first joint pale. Disk of the pronotum broadly pale or ochraceous, the sides usually broadly, sometimes narrowly, black. Scutellum black; its basal lobe, or at least at either side, fulvous. Elytra whitish subhyaline, more or less tinged with bluish-green; narrow scutellar and commissural margins of the clavus blackish, connecting with a transverse oval fuscous spot on the inner angle of the corium. Membrane hyaline, iridescent, with a very faint smoky discal cloud, the nervures brownish. Beneath pale, or with the pleural pieces and margins and the apex of the abdomen black. Legs pale, the femora, knees and tibiæ sometimes a little darker above. Rostrum pale.

Described from numerous examples taken at Leona Heights and Palo Alto, Calif., in August, by Dr. J. C. Bradley and two paler examples taken by me at San Juan Capistrano, June 25th, 1914. I have not yet detected this species in San Diego County but it doubtless will be taken along our river valleys. In this description I have included many generic characters as the genus seems not to have been known to Dr. Reuter. The present species is close to *fasciata* Dist., but undoubtedly distinct. *Paraproba* differs from *Dicyphus* chiefly in the form of the pronotum and may have to be merged with it after a more careful study.

156. *Coquillettia insignis* Uhler. San Diego, taken on chaparral in June.

157. *Closterocoris amoenus* Prov. This pretty insect is one of our most abundant Capsids. It occurs throughout the year on various plants and bushes and is subject to some variation in the depth of its coloring.

158. *Cyphopelta modesta* Van D. One example of this pretty insect was taken by Mr. W. S. Wright at San Diego, May 21st 1913. The unique type was taken by Mr. Fordyce Grinnell at Pasadena in June.

159. *Pilophorus* sp. Found in abundance on willows at San Juan Capistrano in June but not yet taken in San Diego County, although it undoubtedly occurs here.

160. *Pilophorus* sp. One example taken in a ravine at Alpine in October, 1913. As Dr. Poppius has recently published a paper on genus *Pilophorus* which I have not seen it seems better not to attempt to describe new species in this genus at present.

161. *Pamillia behrensii* Uhler. Taken on the mistletoe of oaks at Pine Hill in October, 1913. I also took a few among ants under bark of the sycamore at Alpine in January, 1914. There were mistletoe plants on this tree and it is more than likely that these insects had lived on those plants and were hybernating when taken. My specimens are lighter and more clearly marked than those described by Dr. Uhler but the difference in latitude might account for this.

162. *Diaphnidia provancheri* Burq. Grossmont and Alpine; taken from willows in May and June, and also taken from willows at San Juan Capistrano in June, 1914. These differ in no way from the species as found in New York, Ontario and Quebec.

163. *Diaphnidia hamata* Van D. A few taken at Alpine in June and others from the Cuyamacas at an altitude of 5,000 feet in October.

164. *Orthotylus chlorionis* Say. April to June, occasional about cultivated fields.

165. *Orthotylus coagulatus* Uhler. Alpine, April, 1913.

166. *Orthotylus viridicatus* Uhler. Not uncommon from March to May. Perfectly fresh specimens are irregularly clothed above with deciduous black hairs.

167. *Orthotylus inconspicuus* Uhler. I have taken several specimens of what I believe to be this species at Foster's in May and Alpine in June.

168. *Ceratocapsus elongatus* Uhler. Two large strongly colored examples of this species were taken at Alpine in June. These agree in every essential particular with a long series I took in Colorado in 1900, examples of which I submitted to Dr. Uhler with the request that he compare them with his *elongatus*. He wrote me that they were this species and returned my specimens so labelled so I am holding them under that name although they differ in some respects from his description. Normally the elytra are pale with a broad somewhat V shaped fuscous vitta across the apex of the elytra, its apex covering the base of the membrane. In this species the fuscous apical portion of the membrane is well distinguished and nearly straight.

169. *Ceratocapsus setosus* Reut. One specimen that seems to differ in no respect from Florida specimens in my collection except that it is a little darker, was taken by me in the city park, San Diego, in May, 1913.

170. *Lopidea marginata* Uhler. Abundant on the chaparral throughout the summer. An examination of the Uhler type now in the collection of the California Academy of Science shows that my former determination of this species as the pale-margined form of *media* was erroneous. This species is common over a great part of California and it is the form which has been distributed under the MS name of *Lopidea obscura* Uhler. Generally the clavus as well as the costa is pale.

171. *Lopidea nigridea* Uhler. This large blackish species is abundant everywhere on the chaparral during May and June.

172. *Hadronema robusta* Uhler. Abundant on the "white sage" during May and June, especially on the dry granite hillsides in the back country.

173. *Strongylocoris stygica* Say. Common on sun-flowers growing along the banks of small mountain streams at Mussey's, Alpine and elsewhere from April to June. I have been unable to detect the black legged *atrata* reported as common about Los Angeles by Dr. Uhler.

174. *Strongylocoris croceipes* Uhler. Alpine, May and June, two examples.

175. *Macrotylus tristis* Uhler. Lakeside, Foster and Mussey's, April and May; not common. This species has a strong superficial resemblance to *luniger* as figured by Dr. Reuter but it seems to be sufficiently distinct. There is generally a pale spot on each of the callosities.

176. *Macrotylus regalis* Uhler. My three specimens are much smaller than indicated by Dr. Uhler and differ in some other particulars, and I feel some doubt about the identification but they are all males while Uhler's type specimen was a female and this with the difference in locality may account for the discrepancies. In my males the vertex has a red vitta reaching the base of the tylus, the entire pronotum is red with three more or less distinct dusky vittæ, the median invading the base of the scutellum, the costal margin is black, widening a little to the cuneus; the membrane is smoky with the veins pale; legs testaceous-brown with the femora tipped with pale and the extreme base of the tibiæ and the tarsi blackish; the rostrum is pale, the first joint beneath and the apex blackish; and the sides of the pleural pieces are red. These characters seem almost specific but it does not seem best at present to so consider them. All my specimens were beaten from chaparral in June.

177. *Macrotylus angularis* Uhler. Three examples taken at San Diego on the white sage in April and May, 1913.

178. *Macrotylus vestitus* Uhler. Lakeside and Alpine, May and June.

179. *Oncotylus repertus* Uhler. Mussey's, one example taken in April, 1914, from weeds growing along a stream.

180. *Oncotylus punctipes* Reut. La Jolla and Alpine. Taken on wild honeysuckle. These are a little larger than my eastern specimens but do not seem to differ otherwise.

181. *Lopus decolor* Fallen. Alpine, May; one example.

182. *Psallus anchorifer* Fieb. San Diego and Alpine, April to June.

183. *? Psallus breviceps* Reut. If I have rightly identified this species with material taken here it is perhaps our most abundant and widely distributed Capsid in this part of the state. The males are rather slender and mostly dark, with the legs somewhat paler and a broad white arc on the base of the cuneus. The female is more ovate with the elytra paler at base as noted by Reuter and this coloring is sometimes found in immature males. The antennæ are mostly blackish in both sexes. Dr. Reuter evidently had two pale females before him when describing the species.

184. *Criocoris saliens* Reut. I have found this species abundant on a species of Galium growing on the dry hillsides at Mussey's, Alpine, etc., from April to June. It most certainly belongs to genus *Criocoris*. The form and color of the second antennal joint of the female on which Dr. Reuter founded his genus *Strongylotes* is entirely inappreciable. This species is very close to my *canadensis* but it is little narrower, the second joint of the male antennæ is broader and more flattened and narrowed toward the apex, the extreme base of this joint in the female is concolorous and not black as in my eastern species and the membrane wants the pale markings found there.

185. *Plagiognathus verticalis* Uhler. I took this species in great numbers at Ocean Beach in May, 1913, and have found it common elsewhere during April and May. Uhler's description is very inadequate but I believe I have rightly determined the species. Dr. Reuter's keys for separating this genus from *Psallus* are unsatisfactory. Comparing specimens determined by Dr. Reuter himself I find the eyes are not more granulated nor the last tarsal joint longer in *Psallus*.

186. *Plagiognathus decolor* Uhler. San Diego and Lakeside; April and May. I am much inclined to think that this species would better be left in *Agalliastes (Chlamydatus)* where Dr. Uhler placed it.

187. *Atomoscelis seriatus* Reut. This pretty little species seems to be abundant at many places from San Diego to Alpine from April to September.

188. *Tuponia modesta* n. sp.

Pale green, the elytra nearly white, clouded with greenish; legs white dotted with black; above clothed with white hairs. Length to tip of membrane 2 mm.

Head broad, about two thirds the width of the hind margin of the pronotum, short, nearly vertical; vertex broad, moderately convex, opake; base of the clypeus reaching just above the line of the antennæ; cheeks broad, attaining the fore coxæ, the gula wanting; buccal opening broad. Rostrum reaching the intermediate coxæ. Antennæ long, the basal joint very short, scarcely surpassing the clypeus, second about as long as the pronotum and eye together, linear; third two thirds the length of the second; fourth two thirds the length of the third. Pronotum short and broad, its length about one half that of the hind margin, impunctate, a little polished posteriorly; the callosities distinct, contiguous; collum wanting. Scutellum large, the base broadly exposed. Elytra flat, subhyaline, the costal margin but little arcuated. Hind femora hardly flattened. Last joint of the tarsi nearly as long as the basal two together; claws long, moderately curved, the short arolia on their base.

Color pale green tinged with yellowish on the head and callosities. Antennæ testaceous with a brown dot before. Extreme apex of the scutellum blackish. Elytra whitish, subhyaline, scarcely tinged with green, with about three faint and obscure transverse clouds, one just behind the scutellum, another across the apex of the clavus and the third represented by a cloud on the cuneus; a minute brown point on the tip of the clavus. Membrane whitish with a faint cloud at the tip of the cuneus and a larger one beyond, the nervures white. Legs whitish; femora with about two black points at apex, the posterior with a row of about five along its hind edge; tibiæ with about six black points alternating with black spines. Apex of the tarsi blackish. Beneath a uniform pale green, the tip of the rostrum black.

Described from 13 examples taken in the city park on December 25th, 1912, and during January and April, 1913. This species while it has the broad head of *Chlamydatus* is undoubtedly a *Tuponia*. Its delicate greenish mottled color and dotted legs will distinguish it.

189. *Rhinacloa forticornis* Reut. One example taken at East San Diego in June.

190. *Chlamydatus associatus* Uhler. Hurlburd's Ranch at Descanso, October.

191. *Chlamydatus suavis* Reut. April to June. Abundant.

192. *Chlamydatus bicinctus* n. sp.

Black or piceous-black, polished; antennæ and legs pale; elytra with a transverse white vitta at apex of the scutellum and the base of the cuneus broadly white. Length 2½ mm.

Head rather broad, nearly vertical, moderately produced at apex; vertex wide, convex, highly polished, immarginate; clypeus prominent, its base distinctly above the line of the antennæ; eyes

oval, scarcely sinuated before. Rostrum attaining the apex of the hind coxæ. Antennæ short; basal joint just passing the apex of the head; second as long as the pronotum and eye together when viewed from above; third and fourth together as long as the second in the female, a little shorter in the male. Pronotum short, more narrowed anteriorly in the male, the sides straight; callosities narrow in the female, nearly obsolete in the male, surface polished. Base of the scutellum narrowly exposed. Elytra nearly parallel, flat; cuneus long and acute at apex, nearly horizontal.

Color piceous or black, the elytra usually a little paler. Antennæ testaceous-yellow, dusky at apex. Elytra with a broad white band across just beyond the tip of the scutellum which may be much reduced in the male; base of the cuneus broadly white; membrane uniformly smoky, iridescent, its nervures black. Legs pale yellow or fulvous, the posterior femora fuscous or piceous; tibiæ immaculate, the spines concolorous, the tarsal claws black. Rostrum pale with the tip black.

Described from numerous specimens taken on Ceanothus in the spring, March to June. This species is very distinct by its polished black color with two conspicuous transverse white bands.

193. *Leucopoecila albofasciata* Reut. Common in alfalfa fields throughout the year.

194. *Maurodactylus semiustus* n. sp.

Soiled greenish white more or less tinged with fulvous; membrane uniformly smoky; above clothed with short dark deciduous hairs. Length to tip of membrane scant 3 mm.

Head short, vertical, about two thirds the width of the hind margin of the pronotum, strongly tinged with fulvous; vertex broad, convex, polished; basal suture of the clypeus not distinct, a little above the base of the antennæ. Rostrum almost attaining the apex of the hind coxæ. Antennæ rather long, more or less infuscated; basal joint just passing the tip of the head, thickened at apex; second nearly as long as the basal margin of the pronotum; third and fourth together twice the length of the second, the third twice as long as the fourth. Pronotum short, transverse, the sides arcuated; callosities moderately prominent; surface polished, quite strongly tinged with green on the disk of the callosities, the margins more yellowish. Basal lobe of the scutellum narrowly exposed. Elytra concolorous, polished, with the black hairs more persistent. Membrane uniformly smoky but paler in the areoles, the nervures pale. Beneath are legs concolorous, the basal margin of the venter more greenish or this color may cover the pleural pieces. Tibial spines and apex of the tarsi black.

Described from a good series swept from a low weed found growing on top of the rocky hills at Mussey's, April 11th, 1914. This insect has much the aspect of a *Tuponia* and perhaps should be placed in that genus but in Reuter's key to the genera of this tribe it runs directly to *Maurodactylus*. The uniformly smoky membrane and greenish yellow color, below as well as above, will distinguish this tiny species.

Family VELIIDAE

195. *Microvelia americana* Uhler. Mussey's, August, 1913. Taken from a small canyon pool among the hills.

196. *Rhagovelia obesa* Uhler. Hurlburd's Ranch, near Descanso, October.

Family GERRIDAE

197. *Hygrotrechus orba* Stal. Common everywhere on ponds and streams, March to October. I do not feel satisfied that I can distinguish this from *remigis* Say.

Family SALDIDAE

198. *Pentacora signoreti* Guer. March to May. Common on salt marshes along the coast and on the damp sands of San Diego river as far up as Lakeside. Young in March.

199. *Saldula interstitialis* Say. Abundant everywhere in suitable places throughout the year. I have proposed *Saldula* to replace *Acanthia* of Reuter (not of Fabricius) with *saltatoria* Linn. as type.

200. *Micranthia pusilla* n. sp.

Size and much the aspect of *humilis* Say, but with broader elytra. Elytra deep black with two white costal spots and the membrane strongly distinguished. Length 3 mm.

Head as in *humilis*, black, with a transverse white line at the base of the tylus. Antennæ black, the joints subequal; the first a little shorter, the second longer than the third and fourth. Rostrum black. Pronotum broader posteriorly than in *humilis*, sides nearly straight, the humeral angles a little more rounded; hind margin broadly but shallowly excavated. Scutellum as long as broad, with a shallow transverse impression, and with the pronotum opake, black and closely minutely sericeus pubescent. Elytra with a somewhat longer pubescence; deep black becoming velvety black toward the apex of the corium and on the tip of the clavus; corium with a square whitish spot resting on the costa and a double one close to the apex; usually there is a small white point on the middle of the corium, one at the inner apical angle and another near the tip of the clavus. Membrane strongly differentiated, whitish hyaline, a little infumed, the nervures strong, brown; the areoles with a brown subapical mark and sometimes another near the base. Beneath and legs black, the knees, tibiæ except at base and apex and the tarsi, their tips excepted, pallid. In the female the apex of the abdomen and sometimes the slender hind margins of the ventral segments are pale.

Described from three males and two females taken along the San Diego River at Lakeside, May 7th, 1913, and from a moist ravine at Alpine in June. Dr. J. C. Bradley also took this species at Sisson, Calif., in August, 1908. The species can be easily recognized by its small size, intensely black color, the strongly distinguished membrane and the four white marginal spots on the elytra.

201. *Ioscytus politus* Uhler. I took one example of the typical form of this species as described by Dr. Uhler by a pond in Rose Canyon near La Jolla, in September, 1913. In july,

1903, I found this species not uncommon about a pond at Elitch's Gardens at Denver, Colo., but these were a little larger with the elytra a clear reddish, the clavus only black.

Family NEPIDAE

202. *Ranatra brevicollis* Montd. One female I believe belongs here was captured in a pond near Barona Ranch at Mussey's in August. It was not fully developed and some of its characters were obscure. A very dark male taken by Mr. F. W. Kelsey in Pine Valley in the Cuyamaca Mts. in April may belong here.

Family BELOSTOMIDAE

203. *Abedus (Deinostoma) dilitatus* Say. What I believe to be the young of this species is common in most pools, especially back among the hills, but I have been unable to obtain an adult.

Family GELASTOCORIDAE

204. *Gelastocoris variegatus* Guer.? A very clearly marked form which I have provisionally determined as this is common along the San Diego River as far up as Lakeside. The silvery points on the elytra are very conspicuous in this species. May to July.

Family NOTONECTIDAE

205. *Notonecta mexicana* H. S. Mussey's, August, taken from a shaded pool. If I am correct in my determination of this species it is near *undulata* Say but is proportionately shorter.

206. *Notonecta insulata* Kirby. One example of this species occurred at Mussey's with the preceding but I found it in numbers in a stream at Pine Valley in October, 1913.

207. *Buenoa platycnemis* Fieb. Found in abundance in a pool in Rose Canyon near La Jolla in September.

HOMOPTERA

Family FULGORIDAE

208. *Amycle saxatilis* n. sp.

Allied to *amabilis*, broader and proportionately shorter than in *vernalis;* fuscous, irrorate with pale; tergum and base of the wings red or luteous. Length to tip of abdomen 11 mm., to tip of elytra 13 mm., alar expanse, 21 mm.

Head thin and strongly produced. Vertex a little longer than the pro- and meso-notum together, ligulate, narrowing to the middle then a little expanded and again narrowing to the broad subangular apex. Surface depressed with a linear medium groove and a discal carina either side which diverge at base, before the middle and again at apex, the submargins laminate-carinate. Front nearly flat; apex expanded to before the eyes, feebly sinuated at the an-

tennæ; the disk with fine longitudinal striæ, the carinæ nearly obsolete; clypeus more prominent, feebly convex, compressed and distinctly carinate toward the apex. Pronotum transverse, one half the length of the mesonotum, feebly angularly excavated behind and slightly sinuated, truncate before; disk with three prominent obtuse parallel carinæ and an impressed point on either side, the lateral carinæ placed just inside the outer angles of the vertex; post-ocular protuberance acute but shorter than in *vernalis*. Mesonotum feebly tricarinate, the lateral prominent near their base. Elytra parallel, a little sinuated at their middle, the areolar reticulations obscure basally. Hind tibiæ trispinose; abdomen strongly depressed, with two discal carinæ indicated, but irregular and broken.

Color fuscous brown inclined to greyish, minutely irrorated with pale, varied with darker on the middle field and apex of the vertex, cheeks, sides of the pronotum and on the chest including the apex of the clypeus and the coxæ; front and base of the clypeus paler. Elytra more greyish, minutely varied with fuscous especially toward their apex; the outer claval nervure interrupted by a whitish median spot. Wings smoky hyaline; luteus, or in fully colored examples red, on the basal half; the transverse veinlets and alternate longitudinal nervures heavy and fuscous in the smoky apical part. Tergum and sides of the metanotum fulvous or red, the narrow base and lateral margins and the genital segment fuscous.

Described from three males; two taken on the rocky hillsides at Grossmont and Lakeside in May, 1913, and one beaten from a pine tree at Torrey Pines on July 4th, 1914. I have repeated some generic characters here as no full description of the genus or any species has yet been published.

209. *Orgerius rhyparus* Stal. Taken occasionally from La Mesa to 4,000 feet in the Cuyamacas. Young from February to June, adults from June to October. It seems to prefer the canyons among the hills.

210. *Timodema miracula* Ball. Occurs with the last and well up in the Cuyamacas. Both of these species have the singular habit of standing in a nearly erect posture and when disturbed are powerful leapers. The black color with transverse white bands and flattened legs will distinguish this form.

211. *Orgamara acuta* Ball. I took a typical example of this odd looking insect on North Island, Coronado, June 30th, 1813, and a darker specimen at Lakeside in October. Young in May and June.

212. *Scolopsella reticulata* Ball. Mr. Frank Stephens has taken several examples of this species at La Puerta Valley on the eastern slopes of the Cuyamacas for which I am indebted to Mr. W. S. Wright. It is hardly likely that they occur on this side of the mountains.

213. *Scolops pallidus* Uhler. Abundant everywhere. In this species the disk of the metanotum is conspicuously pale, a character not mentioned by Dr. Uhler. There is a pale form of this species with immaculate nervures.

214. *Scolops piceus* n. sp.

Allied to *Belanocharis fumida* Uhler but certainly distinct. Black marked with whitish on the cephalic protuberance and beneath. Elytra subhyaline picous. Length to tip of cephalic horn 6-7½ mm.

Female: Cephalic horn long and slender, linear, white with a black line above and on either side; disk of the vertex convex, deep black and highly polished, its lateral carinæ marked with two white dots against each eye. Front slenderly tricarinate, regularly widened to the apex which is concavely arcuated; black dotted with pale, broadly white across the apex. Clypeus convex, polished, slenderly tricarinate, its base black with a few pale irrorations, apical portion pale. Pro- and meso-notum black, irrorate with pale. Pleuræ and abdomen black obscurely irrorate with pale. Legs pale the femora more or less varied with fuscous; anterior and intermediate tibiæ triannulated with white, spines of posterior tibiæ black. Elytra piceo-hyaline with a blackish cloud along the basal half of the costa and there may be a cloud at the tip of the first and second apical areoles. The male is smaller and darker with fewer pale irrorations.

Described from one male and three female examples. Mission Valley, San Diego, April; Foster on the rocky hillsides, May; Alpine, July. I cannot make this insect agree with Uhler's description of *fumida* and I believe it distinct. I see no reason for separating these species from Scolops.

215. *Catonia irrorata* n. sp.

Closely related to *fusca* but with the short vertex found in the typical section of the genus; front with two broad white bands; elytra fuscous with pale irrorations and nervures. Length 5-6 mm.

Vertex as in *impunctata* but proportionately wider and shorter, larger in the male but scarcely as long as half the width between the eyes. Front broader than in *impunctata* and *fusca*, the sides very feebly arcuated apex no wider than the base, scarcely excavated for the reception of the clypeus. Pronotum as in *fusca*, narrower and more acutely angled than in *impunctata*.

Color black, carinæ of the vertex, and pronotum and a spot in each basal fova of the vertex pale. Front with a median transverse white band, base broadly and the apex more narrowly deep black, the basal band with two pale points on either side. Clypeus white, blackish at apex. Mesonotum piceous black with ten obscure fulvous spots, two in each lateral and three in each discal compartment. Elytra fuscous-brown with a blackish vitta before the middle and a more obscure and broken one behind and a third indicated by a large spot on the stigma; nervures pale lined with darker, the areoles with about two rows of pale points. Legs very

pale fuscous, the knees, apex of the tibiæ and the hind tarsi paler. Abdominal segments edged with pale.

Described from two examples; a male taken May 6th at Brooklyn Heights in San Diego and a female taken March 11th at Alpine; both from manzanita bushes.

216. *Catonia fusca* Van D. Not uncommon on manzanita (Arctostaphylos bicolor) in the canyons east of San Diego and at Alpine, May and June.

217. *Catonia rubella* Van D. Abundant with the preceding, May and June.

218. *Catonia costata* Van D. Not uncommon on the rocky hillsides at Lakeside, Foster and Alpine. April to June.

219. *Oliarus californicus* n. sp.

Allied to *aridus* but with more of the aspect of *placitus;* elytral maculation of the female forming a short oblique vitta a little beyond the stigma, pale spot on the sides of the front small. Length 7-8 mm.

Vertex distinctly narrower and longer than in *aridus,* more parallel than in *placitus.* Front wider at base than in *aridus,* much wider than in *placitus.* Costal areole of the elytra wider. Male pygofers less deeply excavated than in *aridus,* the sides cut away obliquely to the dorsal angle, this edge slightly arcuated. In *aridus* the sides of the notch are much more nearly parallel and the apex is strongly produced in an obtuse lobe ventrally, the edge retreating dorsally for about half its length; median plate of the female broader and shorter.

Color black tinged with castaneous on the clypeus, median carina of the front, and on those of the mesonotum; lateral carinæ of the front and of the vertex posteriorly whitish; carinæ and hind margin of the pronotum narrowly pale, sides of the front with a small pale spot next the clypeus. Margins of the pleural pieces and ventral segments more or less pale. Legs pale fuscuous, the knees, hind tibiæ and tarsi whitish. Elytra whitish hyaline nervures pale with black punctures armed with long black hairs; before the middle is an oblique row of four black spots placed on the forks of the nervures; the apical and subapical nervures and the stigma clouded with brown and there is an oblique fuscous vitta covering the second apical areole and continued forward nearly to the subapical transverse nervures. These markings may be much reduced or in the male quite absent.

Described from many specimens of both sexes taken at most all places where I have collected in San Diego County, from May to October. This species is so close to *aridus* it is difficult to find good characters to distinguish it but they are obviously distinct. The form of the male pygofers, the small size of the pale spot on the sides of the front will best distinguish the males while the female can be recognized by the small frontal spots and the maculations on the elytra. *Placitus* is a larger eastern form with narrower base to the front and a longitudinal fuscous vitta on the apical half of the elytra of the female; *quinque-maculatus* and *vicarius*

have transverse elytral maculations. In some examples of *californicus* the disk of the mesonotum is distinctly castaneous.

220. *Oliarus complectus* Ball. Abundant everywhere. There are two forms of this species. In the more typical the mesonotum is black with the carinæ at times ferruginous; in the other the mesonotun, or at least the median compartments, is castaneous or at times almost sanguineous. In some examples the elytra are milky hyaline but ordinarily they are hyaline or more or less infuscated. This species has also been found in the east.

221. *Oliarus fidus* n. sp.

A little larger than *complectus;* short and stout; black, elytral nervures heavy and punctate. Length 4-5 mm.

Vertex nearly quadrangular, scarcely longer than broad, but little surpassing the eyes; hind edge deeply emarginate; apical compartments broad, convex; sides rounded, not obviously subangled as in many of our species; clypeal suture indistinct; median carina distinctly forked at the apex of the head; mesonotal keels prominent, the four lateral regularly arcuated. Male pygofers with a shallow notch armed with a short blunt tooth, the sides regularly arcuated; styles slender, strongly curved from their base about an ovate opening, meeting above and then abruptly reflexed, curving backward and outward under the lateral projections of the dorsal plate, the latter narrow and distant, not contiguous as in many species.

Color black, the carinæ of the head and pronotum pale. Rostrum, trochanters, knees, tibiæ and tarsi testaceous; slender margins of the abdominal segments pale; genital segments pale brown. Elytra milky hyaline, nervures strongly dotted with fuscous and armed with black bristles making them conspicuous, the transverse veinlets infuscated. In fully colored females there is a row of three fuscous spots in the costal areole, an oblique row of three on the transverse veins of the clavus and middle of the corium, and some small faint clouds in the anteapical areoles. Stigma small and inconspicuous.

Described from numerous examples taken on the rocky hillside south of the railway station at Foster on May 24th, 1913.

222. *Cixius cultus* Ball. Found occasionally everywhere but more frequently near the coast; May and June.

Genus Platycixius n. gen.

Allied to *Cixius;* head but little narrower than the pronotum; eyes narrow, oblique, feebly emarginate beneath. Vertex large, depressed, with a median carina and the lateral and anterior margins carinately elevated, base feebly arcuated. Front large, scarcely longer than broad, ecarinate, base as broad as the apex, tumid, sides arcuated, laminate outwardly, frontal ocellus conspicuous; clypeus tumid, apparently ecarinate. Pronotum longer than in *Cixius*, tricarinate, the lateral carinæ running oblique and straight to the hind margin, behind the eye is a callous apparently connect-

bose. Hind tibiæ unarmed. Elytra subparallel, the costa arcuated at base; claval veins united beyond the middle; radial and ulnar nervures united by a short transverse vein about half way to the fork of the ulnar; radial forked a little before the outer ulnar; apical areoles eleven, the first three beyond the large stigma transverse. Wings with two transverse veins and two stylate apical areoles. This genus is distinct by its broad convex ecarinate front, broad vertex, the form of the lateral carinæ of the pronotum and the unarmed hind tibiæ.

Type of the genus *Platycixius calvus* n. sp.

223. *Platycixius calvus* n. sp.

Vertex equally long and broad, slightly narrower before and feebly arcuated at apex, the median carina not attaining the apex. Front broadest a little beyond the middle, the apex feebly curved across the base of the clypeus. Pronotum hardly half the length of the vertex, deeply angularly emarginate behind. Mesonotal carinæ subparallel, the median obsolete on apical third. Elytral nervures very obscurely granulated. Length to the apex of the abdomen 5 mm., to tip on the elytra about 6½ mm.

Color black, head, pronotum and legs luteo-testaceous, the former with a blackish shade about the frontal ocellus which extends down either side of the clypeus leaving a pale convex median vitta which is scarcely carinate. Narrow margin of the abdominal ing with the apex of the lateral carinæ at the hind margin. Mesonotum large, tricarinate. Basal joint of the antennæ large, subglo- segments pale. Elytra faintly smoky hyaline, nervures strong, fuscous, a faint fuscous cloud along the apex and a crescentic fuscous mark on the seventh to the tenth apical areoles; stigma large and fuscous, becoming black at either end with a white callous within the base. Wings hyaline, nervures brown.

Described from one female specimen taken near a small stream at Mussey's, on April 12th, 1914.

224. *Microledrida fuscata* n. sp.

Closely allied to *asperata* Fowler but shorter and darker in color. Length 2½ mm.

Vertex produced for one half its length before the eyes, its carinæ strong. Front rather strongly inflated, distinctly transverse, the carinæ distinct but not as strong as those of the vertex, the frontal ocellus barely indicated. Clypeus long, acutely triangular, its basal suture regularly arcuated. Pronotum about one half the length of the vertex, its margins nearly parallel, median carina strong. Mesonotum longer than the vertex, tricarinate, the median feeble. Elytra broad, strongly inflated near the base, the sides almost straight for a space, apex subangularly rounded, with ten areoles beyond the stigma, the fifth and eighth small and triangular; nervures strong, punctate. Male genital segment broadly excavated the base of the sinus sometimes with a feeble tooth; stiles divergent at base, converging above leaving an oval opening, the subacute inner angle of the hammer-shaped apices in contact, their apical margins sinuated, not arcuated as in *asperata;* pygofers a little exceeding the plates.

Color fuscous-brown, obsoletely irrorated with pale on the head, pronotum and scutellum; clypeus, femora and abdomen black or nearly so, sometimes white pruinose; the latter with margins of the segments narrowly touched with fulvous. Anterior and intermediate tibiæ pale, tipped with fuscous. Elytra whitish, nearly opake, nervures and stigma fuscous, the former with large black punctures bearing black bristles; anterior fracture of the stigma white; apical margin with a fuscous spot at the tip of each nervure. In fully colored individuals there is a fuscous cloud at the base of the corium covering the basal disk of the clavus; two equidistant oblique fuscous spots on the costal area, the anterior of which may be continued behind in a large discal spot, and a rather vague smoky cloud across the base of the membrane, intensified on the stigma and base of the median apical areole. In pale examples the median fuscous band may be reduced to two spots on the costa, one on the disk, and a point at the apex of the clavus, and the posterior band to the two intensified spots. Commissural nervure always whitish.

Described from numerous examples beaten from a bush of Heteromeles (Christmas berry) at Alpine, San Diego Co., Calif., March 11th, 1914. These specimens may be slightly brachypterous which would account for their elytra being shorter than in Fowler's figure, but the color of the body and legs is much darker, the elytra are more maculated and the form of the male genitalia is different.

225. *Myndus occidentalis* n. sp.

Allied to *radicis* Osb. but more deeply colored; luteus to fulvous-yellow; front immaculate; elytral nervures dark. Length 4 to 4½ mm.

Vertex long as in *radicis* but less narrowed anteriorly. Front proportionately narrower than in *sordidipennis*, the sides not so strongly angled as in *radicis*. Pronotum reduced to a mere line at center. Elytral nervures infuscated and distinctly punctate as in *sordidipennis* but the costal nervure not heavier and the stigma hyaline, its basal nervure only thickened and brown. Last ventral segment deeply excavated with a blunt tooth in the fundus, the sides parabolic; pygofers of the male long, exceeding the connexival segments by at least a third of their length, the apical margin but slightly oblique; anal style black and considerably surpassing the tube.

Color fulvous, a little paler on the head, pronotum and legs; front immaculate. Elytra and wings hyaline with the nervures distinctly brown. Eyes, sides of the metanotum, an area on the tergum and the tarsal claws blackish.

Described from four male and three female examples taken at Lakeside in May 1913. Some of the specimens are darker or almost testaceous brown and it is possible that they represent the fully adult coloration.

226. *Oecleus decens* Stal. The species which I have so determined is not uncommon back from the coast from May to August. It differs from the eastern *borealis* in being larger and in having a somewhat different male genitalia. The color is darker than described by Stal but we find the same range of color in a number of allied Cixiinæ. I prefer to place this form under *decens* until comparison with Mexican material is possible.

227. *Oecleus venosus* Van D. Several examples taken along the San Diego river at Lakeside and back of the sand dunes at Ocean Beach, all in May 1913.

Genus Oeclidius n. gen.

Vertex narrow as in *Oecleus* but widest at base and not at apex as in that genus. Front very narrow, concave, uniformly widening from the base to the clypeus, the carinate margins well elevated; median carina and apical ocellus wanting, the position of the latter sometimes indicated by a dark point. Clypeus slender, tricarinate. Pronotum narrow, angularly emarginate behind, with median keel and concentric anterior carina behind the eyes. Mesonotum tricarinate. Basal joint of the antennæ longer than wide, papillose. Hind tibiæ simple. Eyes notched beneath. Elytra short and broad, vitreous, the two claval veins straight, united before the middle, at tip reaching the commissure by a hook some distance from the apex; costal area very broad and expanded near the base; outer sector forked near its base and both opposite the apex of the clavus where they are united by strong transverse veins forming five anteapical areoles of which the inner and third are small and triangular. Middle apical areole elongate, oblong, interior to which are five (two stylate) and exterior four, their three veins springing from the side of the long median areole. All the nervures distinct, impunctate.

This genus differs from *Oecleus* in having the vertex narrower before, in the narrower ecarinate front the papillose basal joint of the antennæ, the angularly emarginate pronotum and the elytral venation. It bears some resemblance to *Micrixia* Fowler but can at once be distinguished by the narrower vertex and front and different elytral venation. It bears a superficial resemblance to *Brixia* but has not the elongated second joint of the antennæ found in that genus.

228. *Oeclidius nanus* n. sp.

Closely resembling *Oecleus tenellus* Fowler, which doubtless pertains to this genus, but smaller. Length to the tip of the closed elytra 3½ mm.

Vertex attaining the front line of the eyes, the base of the frontal carinæ only projecting; deep black, the carinæ white, hind margin of the eyes flavous. Front and clypeus testaceous, the strong lateral carinæ of the front paler; ocelli black. Rostrum reaching the last ventral segment, infuscated at apex. Pronotum white with the disk behind the eyes black. Mesonotum black, the

and meta-pleura infuscated on their disk. Abdomen black the extreme apex and larger lateral angles fulvous; carinæ pale; mesomargins slenderly pale. Legs soiled testaceous, the tarsal spines infuscated. Elytra faintly hyaline-smoky, the nervures fuscous, those at apex stronger, the transverse nervures more heavily infuscated, with a larger smoky spot behind the stigma and another beyond the apex of the clavus. Wings vitreous with fuscous veins.

Last ventral segment of the male with a deep oblong sinus including most of the genitalia; pygofers slightly emarginate below, the stiles ligulate and approximate, at their apex extended laterally, and truncate, their apex considerably exceeded by the narrow pygofers.

Described from numerous examples swept from weeds, grasses and low bushes at East San Diego, La Mesa, Lemon Grove, Lakeside and Alpine in San Diego County, California, during April and May 1913.

229. *Dictyssa marginepunctata* Melich. Of this nearly black species I have taken single examples at San Diego, Lakeside, Mussey's and in the Cuyamacas, May to October. Taken on Adenostoma.

230. *Dictyssa obliquua* Ball. May to August. Common. This and the following species are to be found on sage brush, Artemesia.

231. *Dictyssa mutata* Melich. Common in May.

232. *Dictyssa fenestrata* Ball. La Jolla, June 25th, 1913; three examples.

233. *Dictyssa transversa* n. sp.

Small, pale grey; Elytra hyaline, veined with brown and crossed by two brown vittæ. Length 2½ mm.

Cinerous brown; front brown with whitish carinæ boarded with darker. Vertex, pro- and mesonotum varied with darker and with the median carinæ obscurely paler; abdomen dark brown. Elytra whitish hyaline, reticulated with brown nervures and crossed by two narrow transverse brown vittæ; the anterior at about the middle and more or less interrupted, the posterior just beyond the tip of the clavus, entire but somewhat irregular. The front a little narrower than in *mutata*.

Described from numerous specimens mostly taken on the slopes of Mt. Soledad at La Jolla, from September to November. Also taken at Alpine in March and October and at Torrey Pines in June. The closely reticulated hyaline elytra and the small size will distinguishe this species. Like most of its congeners it lives on Artemesia.

234. *Naethus fenestratus* Melich. Mussey's and Alpine, June to August. On oaks in the chaparral.

235. *Naethus nigronervosus* Melich. June to October. Abundant on scrub oaks.

236. *Dictyobia permutata* Uhler. Foster, May; one example.

237. *Dictyobia atra* n. sp.

Size and form of *permutata;* deep black with a few pale marks on the carinæ and sutures, the elytra areolate with whitish-hyaline. Length 4-5 mm.

Closely allied to *permutata* and presenting no really good structural characters. It may, however, be readily distinguished by its velvety black color, especially on the elytra, becoming somewhat fuscous on the head, pronotum and scutellum with the carinæ slenderly and interruptedly edged with pale; disk of the front on either side and the clypeus brownish and there is a row of pale points near the lateral carinæ of the front, sometimes obscure; meso- and metasternum whitish. Pleural pieces more or less edged with pale; tip of the coxæ, knees and tarsi in part also pale. Abdomen black, the genital pieces and adjoining segments edged with pale; extreme tip of the mesosternum conspicuously pale. Elytra closely reticulated, the pale vittæ obscured by black veinlets; none of the pale areoles materially larger as they are in *permutata*. These pale areoles form a diagonal vitta from the middle of the clavus to the costa behind the middle; this vitta is expanded on the costa and constricted or almost broken at the middle where it sends a branch consisting of two areoles toward the inner apical angle. There is a pale spot consisting of from four to five areoles on the costal margin almost midway between the end of the vitta and the base. The costæ and apical margins have a row of white marks which become more regular and oval around the apex, and within this row at apex are two or three larger white areoles. All these markings consist of small whitish-hyaline aeroles separated by the black veinlets.

Described from numerous examples taken on the chaparral from May to July, particularly at Alpine. This may be but a color variety of *permutata* but it is as distinct as are the several species of *Dictyssa*.

238. *Danepteryx manca* Uhler. Abundant everywhere on Adenostoma and Artemesia. It comes to maturity about April 1st but specimens may occasionally be found throughout the autumn and winter. This species varies from a fulvous brown to dark fuscous and sometimes a dorsal stripe and the elytra are whitish or grey.

239. *Acanalonia mollicula* n. sp.

Form of *clypeata* nearly but with the elytra more narrowed toward their apex. Pale green or brownish with the sutural and apical margins slenderly brown. Length 5-6 mm.

Vertex as in *clypeata*, distinctly subangularly produced, a very little longer on the middle than next the eye, slightly depressed on the disk, the anterior edge rounded. Front prominent basally, transversely convex, broader than its greatest length, deeply, angularly excavated for one half its length to receive the base of the clypeus. Pronotum scarcely as long as the vertex and like that obsoletely carinate. Mesonotum with the lateral carinæ feeble but descernable. Elytra nearly half as wide as long, costa strongly

rounded on the basal one third where they are widest, then narrowing and more feebly arcuated to near the apex which is regularly arcuated to the apex of the clavus. Costal area basally nearly twice the width of the first discal areole; reticulating nervures fewer than in *clypeata*.

Color dull green, or brownish in immature examples, with the costal margin broadly paler at base becoming nearly brown about the apex and still darker on the commissure of the clavus. Legs and clypeus pale brown; eyes dark brown.

Described from six examples, representing both sexes, taken in the country back of San Digo, California, mostly on the hills along Mussey's Grade beyond Foster, August 4th and 5th, 1913; one from Alpine at an altitude of 2,000 feet on October 4th, and one from the Cuyamaca mountains on October 5th at an altitude of 5000 feet.

This is nearest *clypeata* but the larger size and rounded base of the clypeus will distinguish that species. These both have the apex of the head a little produced but less so than in *conica* Say.

240. *Ormenis infuscata* Stal. San Diego and Alpine, May to July.

Rhynchopteryx n. gen.

Allied to *Cyarda* but much shorter; elytra scarcely longer than broad, produced in an abrupt tail at apex of the clavus.

Head bluntly conical, the vertex flat, a little depressed along the disk, passage to the front rounded. Front transverse, ecarinate, but little wider than long; sides narrowly foliaceous-carinate, feebly arcuated, apical margin a little concave; clypeus ecarinate. Pronotum shorter than the vertex rounded before, feebly subangularly excavated behind. Mesonotum about one and one half times the length of the pronotum, obsoletely bicarnate. Elytra scarcely longer than broad, much inflated, valvate, meeting below from the cauda nearly to the middle; the curve of the costa almost a parabola in the male, more oblong in the female; commissural angle produced in an abrupt lanceolate process; base of the clavus strongly granulate and there are a few scattering granules in the apical areoles; commissural margin of the clavus smooth and depressed and connected with an oval depressed area at about the middle of its length. Neuration reticulate over most of the surface, the longitudinal nervures scarcely traceable; transverse nervures of the costal area more regular; ulnar tubercle and base of the clavus prominent. Hind tibiæ with one tooth.

Type *Rhynchopteryx caudata* n. sp.

Differs from *Cyarda* by the broader front, longer vertex, shorter pro- and mesonotum and the short gibbous caudate elytra.

241. *Rhynchopteryx caudata* n. sp.

Dull testaceous brown varied with fuscous. Length to the tip of the cauda 4½-5mm.

Front impressed at apex; vertex with an impressed point on either side near the eye; pronotum scarcely reaching the middle of the eye; apex of the clavus prominent, rounded, surpassing the

apical margin of the corium; cauda lanceolate, extending beyond the tip of the clavus for three or four times its width at that point.

Color dull yellowish or testaceous brown varied with darker or fuscous; base of the front darker, a broad brown vitta extends from near the apex of the vertex to the tip of the mesonotum, sometimes including a pale median line. Generally the elytra are darker above with a fuscous cloud on the base of the clavus and about three along the middle of the corium, and there are two rows of brown points toward the costa. Cauda fuscous with a pale mark behind the apex of the clavus. Abdomen fuscous with the edges of the segments paler. Tip of the rostrum black. Whole insect more or less pruinose at times.

Described from numerous examples swept from wild sunflowers at La Jolla, Calif., in August, 1913. Very distinct by its broad valvate elytra abruptly produced in a short tail at apex.

242. *Lamenia californica* Van D. Taken on willows at Lakeside and Musseys, May to August.

243. *Megamelus marginatus* Van D. Coronado, June.

244. *Pissonotus marginatus* Van D. San Diego, December. One male with black femora and tibiæ.

245. *Pissonotus delicatus* Van D. April to June. Swept from a fine grass growing on low spots. This species was described from a pale female; they are mostly darker.

246. *Pissonotus frontalis* Crawf. Seven examples which seem to be correctly referred here were taken on grass growing along water courses from San Diego to Alpine. They differ from *aphidioides* in being a little smaller, in having the frontal carina forked on a line with the lower angle of the eyes, the branches parallel, closely approximate and obscure over the apex of the head; antennæ black beneath, apex of the front narrowly pale. The styles of the male are not "spatulate" but are transverse at apex as figured by Mr. Crawford, with their inner angles acute and black. This genus is quite distinct from *Dicranotropis*.

247. *Stobaera tricarinata* Say. Common, throughout the year.

248. *Stobaera concinna* Stal. Grossmont, in low lands near the flume. May. Crawford unites this species, *affinis* and *minuta* with *tricarinata* but they are quite distinct.

249. *Stobaera minuta* Osb. Alpine and Torrey Pines, May and June. In these the orange dorsal vitta is conspicuous.

250. *Stobaera bilobata n. sp.*

Much smaller than *tricarinata* with the elytra fuscous marked with a bilobate costal area. Length 1½ to 2 mm.; macropterous 2¾ mm to tip of the elytra.

Head narrower than in *tricarinata;* fovæ of the vertex deep; front narrow, much constricted above, the sides slightly concavely arcuated. Lateral carinæ of the pronotum strongly arcuated, at-

taining the hind margin a little exterior to those of the mesonotum. Macropterous elytra a little shorter than those of *tricarinata*. Male styles divergent and curved, tapering gradually from base to near the apex where they are abruptly bent and narrowed to an acute point, the points meeting above an ovate opening. Anal tube without ventral prolongations on either side. Tibial spur narrower than in *tricarinata*, scarcely more than half the length of the first tarsal joint.

Color variable as in *tricarinata*, in fully matured examples testaceous tinged with yellowish on the head, above blackish. Front obscurely dotted with pale especially toward its base; vertex immaculate or the carinæ paler, the eyes anteriorly pale or subcarneous. Pro- and meso-notum smoky or almost black, the carinæ touched with paler. Tergum dusky either side or at times almost black. Elytra smoky becoming nearly black on the base of the clavus and the inner base of the corium and on the square stigma; costa broadly white, divided into two lobes at the stigma, the basal lobe sloping off to the base of the costa, the apical subtriangular, occupying about half the membrane; nervures concolorous, sparingly dotted with black; commissural nervure white broadly interrupted with black on the apex of the clavus. Tips of the tarsal claws black. In pale examples the elytral markings become indistinct.

Described from numerous examples representing both sexes, taken at Alpine, Mussey's and Torrey Pines from June to August. I have tried to identify this form with *nigripennis* Crawford but it seems to be entirely distinct. All the carinæ are very sharply defined in this species. The Torrey Pines specimens were taken on Biglovia.

251. *Liburnia consimilis* Van D. April to June. Abundant along water courses.
252. *Liburnia lineatipes* Van D. Lakeside, May.
253. *Liburnia occlusa* Van D. Lakeside and La Mesa, May to June.

Family CICADIDAE

254. *Proarna crepitans* n. sp.

Allied to *maura*, smaller and darker than *valvata*. Length to tip of abdomen 22 mm. to tip of elytra 34 mm., alar expanse 62 mm.

Male: Head as wide as the anterior lobe of the pronotum; front strongly striated, without median sulcus. Sides of pronotum strongly sinuated; humeral angles less produced and more rounded than in *valvata;* anterior lobe more angled. Rostrum reaching onto the hind coxæ. Opercula large, rounded apically, the sides quite strongly sinuated. Last ventral segment long, subtriangular, its apex roundedly emarginate; valve shorter than the last ventral segment, ovate, apex somewhat compressed and almost emarginate, dorsal aspect of the genital segment produced in a prominent subacute tooth, shorter and more angled than in *valvata*.

Color black. Vertex with three obscure pale marks on the posterior margin, another on the antennal ledge and a transverse one on the base of the front superiorly; front pale or fulvous with

a median wedge-shaped black vitta with its point on the base of the clypeus, superiorly nearly attaining the antennal ledges and bisected by a pale median line; clypeus pale, black at apex. Antennæ black, becoming pale at apex. Rostrum pale, black at apex. Pronotum with the hind margin broadly and the sides slenderly obscure castaneous-brown; two approximate points near the hind margin and a larger one in the depressed submarginal area on either side castaneous. Metanotum with the center of the cruciform callous and a mark at each of its four extremities pale or castaneous. Tergum with a small pruinose spot on either side of the third segment; genital segment pruinose. Elytral nervures pale or castaneous slenderly edged with black; costal nervure black. Beneath and legs pale; disk of the pleural pieces, upper surfaces of the coxæ and femora, a spot on the base and apex of the tibiæ, tarsal claws and the connexivum black, the edges of the connexival segments pale. The pale color on the lower surface may be more or less tinged with fulvous or castaneous. Basal nervures of the second and third apical areoles of the elytra with a conspicuous fuscous spot.

Described from seven male examples taken in Mission Valley on the hillside opposite the city of San Diego, July 9th 1913. This species makes an unusually loud crackling noise which is often repeated and well sustained, but the insect was very active and difficult to capture, especially as its home was among the cactus on the steepest part of the hill.

I have a Mexican *Proarna*, perhaps *maura*, which is very near this but it is larger with the pale markings above more extended, the antennæ are pale, the rostrum black with the basal joint only pale, the legs and venter mostly fuscous and the genital characters are different. In both species the colors beneath are much obscured by an abundance of white pruinescence.

255. *Okanagana vanduzei* Dist. Taken in the back country only; Sweetwater Valley, June 19th, 1913; Alpine, June 8th and July 4th, 1913. I have found only the males. One of these was singing in the mouth of its hole and beneath it was a cottony mass which did not contain eggs and the nature of which I have been unable to make out. This species had a loud, shrill and continued note.

256. *Okanagana vanduzei* var. *consobrina* Dist. Abundant everywhere along the coast and extending up the valleys for a mile or two and at San Juan Capistrano at least five miles; May 22nd to July 25th. This species has a shrill thin continued note and is not difficult to locate. Like the preceding it sings within its hole but near the surface of the ground. Ordinarily however it rests on grass or weeds near the ground while the preceding is found on the chaparral.

257. *Okanagana californica* Dist. Taken from Eriogonum and Artemesia bushes growing on the adobe lands at Alpine, June 21st to July 4th, 1913. It is a slighter and much more clearly marked species than the foregoing.

258. *Okanagana blaisdelli* Uhler. There are two quite distinct forms taken here which have evidently been confused by Dr. Uhler in drawing up his description. I have one specimen which I believe represents the true *blaisdelli* as it agrees with Uhler's description in being "long, narrow and parallel sided." It also agrees in the remarkably heavy elytral venation and in most of its other characters. It disagrees in the form of the last ventral segment which is here quite regularly narrowed to a scarcely emarginate narrow apex and in having the yellowish color less extended on the head and pronotum. The size given by Dr. Uhler covers both of these forms so it has little value; my specimen corresponds almost exactly with his smallest dimensions. My single male specimen was taken at Alpine, June 20th, 1813, from the chaparral.

259. *Okanagana dstanti* n. sp.

This species is much broader and stouter than the form determined above as *blaisdelli*, being fully as broad as *rimosa* and *vanduzei*. It differs from *blaisdelli* as restricted above, aside from its form, in having the sides of the pronotum anteriorly more rounded and scarcely if at all crenulated and in having the opercles regularly rounded at apex or at most very obscurely sinuated. The elytral nervures while heavy are much less so than in *blaisdelli* and are mostly pale. The pale colors of the whole insect are more extended and the posterior pair of pale spots on the disk of the mesonotum are larger posteriorly and enclose a black point.

This is evidently a still plastic species of which I have taken three forms or varieties here. What I call the typical form is common on the high pueblo lands between La Jolla and Torrey Pines during late May and early June. It is larger measuring 25 mm. to the tip of the abdomen and 33 to the apex of the elytra with a pronotal width of 11 mm. making it the broadest of our species. Here the sides of the pronotum while deeply sinuated are little expanded anteriorly, the last ventral segment is long and regularly narrowed to the rounded apex and the nervures of the elytra are pale before the nodus, excepting only the first ulnar.

Another form which I propose to call (260) var. *truncatus* occurs in numbers about the city of San Diego during June. It has the last ventral segment broad and truncated at apex which is more or less inclined to be sinuated, sometimes strongly so, the sides of the pronotum are more deeply sinuated and strongly expanded anteriorly, and the second ulnar nervure only is black, in whole or in part, before the nodus. It is smaller than *distanti*.

A third form which I propose to call (261) var. *pallidus* is still smaller measuring but 22 mm. to the tip of the abdomen and 30 to the apex of the elytra. It has the last ventral segment long and truncated but not at all sinuated at apex, the sides of the pronotum are but little sinuated and not at all expanded anteriorly, and the colors are much paler, the yellowish markings being much extended, especially on the pronotum where they cover a large part of the

surface, the elytral nervures are almost entirely pale to the base of the apical areoles. This form has been taken only on the low ground near the coast at National City in June.

This species as a whole has the elytra wider than in *blaisdelli* with the costa quite distinctly bent at about the middle. It is a powerful flyer and makes a loud rattling noise at intervals of from ten to thirty minutes, depending apparently on the strength of the sunshine. One will start sounding and the impulse will spread to others near until the whole field is flooded with an indescribable din. After from fifteen to thirty seconds it will stop about as it started. This peculiarity of shrilling makes it all but impossible to locate their sound and with hundreds about you it is hard to find one.

262. *Tibicinoides cupreo-sparsa* Uhler. This very pretty little species was abundant this season from April 26th until nearly the first of June. It occurs almost exclusively on a certain fine tufted grass, probably a Poa, growing on the hillsides about La Jolla and up Mission Valley and adjacent canyons as far as the old Mission and perhaps farther. The The bright red on the base of the wings gives this species a lively appearance when spread. Like *hesperia* Uhler it has the basal one half of the elytra infuscated. It has a shrill but feeble note which is long continued and easy to locate but can rarely be heard for more than one hundred feet.

263. *Platypedia minor* Uhler. Exceedingly abundant everywhere near the coast this season and not uncommon as far back as Alpine. The first specimens were taken on March 22nd and occasional specimens were found as late as July. It makes a short peeping noise constantly repeated but it is not an easy sound to locate. It varies much in size and seems to prefer grassy places.

Family APHROPHORIDAE

264. *Aphrophora angulata* Ball. San Diego, Lakeside and Alpine. May to July. Taken on willow.

265. *Clastoptera obtusa obtusa* Say. Alpine, October; one example.

266. *Clastoptera obtusa achatina* Germ. Beaten from pine trees in the Cuyamacas in October, 1913.

267. *Clastoptera lineaticollis* Stal. May to October, not uncommon.

Family MEMBRACIDAE

268. *Ceresa bubalus* Fabr. Occasional on willows but not as abundant as in the east.

269. *Ceresa albidosparsa* Stal. May to October, common.

270. *Stictocephala inermis* Fabr. One male taken in San Diego, January 1913.

271. *Stictocephala festina* Say. Abundant everywhere on alfalfa throughout the year; the var. *rufivitta* occasional with the typical form.

272. *Stictocephala nigricans* n. sp.

Form of *collina* but smaller with the clypeus more produced; greenish fuscous or almost black, usually distinctly dotted with pale. Length 5½ to 6 mm.

Head unusually flat and regularly rounded before, the clypeus scarcely advanced beyond the line of the cheeks; surface not perceptably rugose, with a distinct incised median basal line. Pronotum much depressed as in *gilletti*, the acute decurved apex almost reaching the tip of the abdomen; metopidium moderately convex, its sides narrowing from the base, curving back and meeting behind the middle. Elytral nervures strong, subinfuscated. Last ventral segment of the female deeply cleft almost to its base, the sides of the sinus arcuated nearly to the lateral angles. Color normally greenish fuscous, mottled or dotted with pale. Metopidium paler and at times without the mottling. Face usually pale with the tylus and apex of the cheeks blackish and there may be three darker basal clouds. Body beneath black; rostrum, legs and apex of the genital segment in both sexes pale.

Described from numerous specimens swept from alfalfa on which it is almost as abundant throughout the year as is *festina*. This species seems to be very near Fowler's *fusca* but his figure shows an insect with a higher pronotum with the metopidium conspicuously widened upward for some distance from the base; he also describes the abdomen as pale while it is black in even the palest specimens I have of *nigricans*.

273. *Parantonae hispida* n. sp.

Pale testaceous or yellowish, obscurely marked with ferruginous and dotted with black; pronotum semivitreus and with the head armed with long erect bristles. Length 6 mm.

Head uneven, polished; anterior edge slightly recurved, truncate on either side of the clypeus and rounded toward the eye; clypeus large and tumid at base. Pronotum moderately elevated; obscurely punctate or subareolate, divided into three lobes by transverse impressions, the anterior less profound; anterior lobe tumid either side above the obtuse humeral angles; no supra-humerals; intermediate lobe smaller, ovate, compressed below where there is a bulbous expansion next the margin; posterior lobe less inflated, subglobose, broader than high, in the male about attaining the tip of the abdomen, armed behind with an abrupt slender spine which reaches the apex of the inner areole of the elytra. Head and pronotum armed with long stiff black bristles interspersed with slightly shorter pale ones, the black ones about as long as the distance between the ocelli and eyes. Elytra entirely hyaline, with strong nervures. Last ventral segment of the female deeply, broadly emarginate almost to its base.

Color pale flavo-testaceous, the pronotum semivitreus, more

or less distinctly mottled with ferruginous omitting the unarmed compressed sides of the median lobe, the terminal spine pale with the extreme tip and a subapical annulus black. Both the anterior and posterior lobes may at times be marked with black above. Head with twelve black points; three against each eye, four on the base of the clypeus and two between and above the ocelli, any or all of which may be wanting. Elytral nervures sometimes touched with brown in places. Legs pale marked with seven black points, two on each side of the femora, two on the base of the tibiæ exteriorly and one at its apex. Tergum marked with a black or brown point on either side at base or the disk may be almost wholly black in the male. Venter sometimes infuscated or even black in the male.

Described from numerous specimens taken on Malvestrum during May and June. This peculiar looking Membracid differs from the only previously known species by the semivitreus texture of the pronotum, the longer and stiffer hairs and by the proportionally smaller posterior lobe of the pronotum, but it is very close to this genus and I believe can best be placed there.

274. *Micrutalis occidentalis* Godg. Taken in great numbers on a graceful branching Chenopodium having a powerful sickening odor and growing commonly on the sandy flats at Lakeside, Mussey's etc., July and August. The form described as *binotata* by Goding is a mere color variety found everywhere with the pale form and scarcely deserving a varietal name.

275. *Micrutalis parva* Godg. Large numbers of this species were taken on the common oak mistletoe at Pine Hills in October. Its smaller size and more depressed form will best distinguish it from the preceding, but other characters may be found in the shorter face and the narrower sinus of the last ventral segment of the female. The prevailing color of this species is a greenish-white less tinged with fulvous than is the preceding; the black marked form occurring with the pale but in less abundance than in *occidentalis*.

276. *Telamona pruinosa* Ball. Five examples taken on scrub oak at Alpine in June and one from willow at Santa Ysabel in October. Those from the oak are a little smaller and greener than the typical form from the east but I do not think them distinct.

277. *Telamona declivata* Van D. One example beaten from alder trees in the Cuyamaca Mts. at an altitude of 5000 feet in October 1913. It is a little more green than eastern specimens with the humeri rather less prominent and the dorsal hump wants even a trace of the hind angle, but I can find no specific characters by which to separate it.

278. *Telamonanthe rileyi* Godg. Not uncommon on oaks from April to August.

279. *Cyrtolobus limus* Van D. A form which I cannot distinguish from this species is not uncommon on oaks at Alpine and Mussey's from April to October.

280. *Platycotis minax* Godg. Taken occasionally on oaks but not at all common. *Platycotis asodalis* Godg. is the unarmed form of this species.

281. *Philya californiensis* Godg. Shorter and broader than *dubia* but with the pronotal horn more elevated and compressed; the whole surface rough, obscurely pitted and transversely corrugated. Sides of the protuberance strongly compressed with the nodular apex broad with distinct carinæ. Dorsal carina when viewed from above wavy and interrupted by the pitting of the surface; posterior process with a distinct lateral carina which in the female is bifurcated; the lateral carinæ of the protuberance are very prominent or subfoliaceous toward the apex but below become lost in the corrugations of the surface; the frontal carina prominent and corrugated. Apex of the front tumid, the cheeks forming a small but obvious lobe on either side. Clypeus convex, nearly horizontal. Elytra entirely coriaceous and punctured, the nervures much reticulated especially beyond the middle. Color brownish grey a little mottled along the median carina with groups of fuscous punctures. Length 7 mm.

In July, 1914, I found this species on a bushy composite plant growing commonly in low places at San Diego. This plant has white flowers like an Ageratum and a plumose foliage which keeps very green throughout the dry season. Goding's description of this insect is absolutely unrecognizable. Our insect is not ferruginous or mottled with pale toward the apex or tuberculate as described by Goding, but it is more robust with the anterior horn shorter and more elevated and with a slight sinus at its base and the elytra are coriaceous. These are all the characters Goding mentions but I feel little doubt but this is the insect he had before him.

I have another *Philya* from the same lot from which I sent specimens to Goding on which he founded his *Aechmorpha ferruginea* but it would be impossible to recognize that species from his description. It is to be hoped that Goding's collection will eventually fall into the hands of some entomologist who can redescribe his species so they can be recognized.

Family TETTIGONIELLIDAE

Subfamily PAROPINAE

282. *Koebelia interrupta* Ball. Not uncommon on the chaparral from March to September. My material varies greatly in color but apparently we have but one species. I am unable to separate this genus satisfactorily from *Paropulopa* Fieb.

Subfamily BYTHOSCOPINAE

283. *Agallia oculata* Van D. Fairly abundant on elderberry trees which seem to be its native food. I have found the larvæ about half grown in June.

284. *Agallia 4-punctata* Prov. Lakeside and Mussey's. May to August. Mostly paler in color than eastern specimens.
285. *Agallia sanguinolenta* Prov. San Diego, Mussey's and Alpine, May to August. Smaller and darker than eastern specimens.
286. *Agallia cinerea* Osb. & Ball. Alpine and Mussey's. June to August; not common.
287. *Agallia californica* Baker. Common throughout the year.
288. *Agallia lyrata* Baker. Occasional throughout the year.
289. *Idiocerus amoenus* Van D. Taken on cedar in the Cuyamaca Mts. in October. Also taken at Mussey's in April.
290. *Idiocerus nervatus* Van D. Taken on cedars with the preceding.
291. *Idiocerus verticis* Say. Also taken with the foregoing on cedars.
292. *Idiocerus sp.* Found on Monterey cypress in the city park in January, 1913.
293. *Idiocerus snowi* Gill. & Baker. May to August. Found on willows.
294. *Idiocerus sp.* Common.
295. *Idiocerus sp.* Common on Ribes speciosum and on the chaparral. I have also taken it on Rhus integrifolia. May to August.
296. *Macropsis occidentalis* Van D. San Diego and Alpine; occasional on willows during May and June. I found it at San Juan Capistrano on willows in great numbers, June 24th, 1914.
297. *Macropsis nubila* Van D. Alpine, June. I cannot find that genus *Oncopsis* is represented on the west coast.
298. *Bythoscopus robustus* Uhler. Alpine and Mussey's, March to August. I took it at Torrey Pines in June in great numbers on a shrubby composite plant allied to Solidago.
299. *Bythoscopus franciscanus* Baker. Common throughout the year; found largely on a shrubby sunflower.
300. *Bythosopus atra* Baker. A few taken on the Cuyamaca Mts. in October.

Subfamily TETTIGONIELLINAE

301. *Oncometopia lateralis* Fabr. What I believe to be a form of this species is found ocasionally on grasses and weeds along water courses among the hills. It is smaller and greyer and has the vertex more produced than the eastern form.
302. *Homalodisca liturata* Ball. Mussey's, April 11th, 1914, on the rocky hillside.
303. *Tettigoniella hieroglyphica* Say. Two forms of this species. one of them very near to *confluens* Uhler, are common throughout the year.

304. *Tettigoniella gothica* Sign. Abundant everywhere throughout the year.

305. *Tettigoniella circillata* Baker. Found on Xanthium strumarium and other weeds growing in low rich ground. May to October.

306. *Tettigoniella sp.* Common everywhere in gullies and canyons where there are damp spots overgrown with a fine grass. June to October.

307. *Draeculacephala mollipes* var. *minor* Walk. Common throughout the year in damp places.

308. *? Errhomenellus irroratus* Ball. March to May, on Adenostona. This does not agree with Dr. Ball's description but I cannot think it distinct.

309. *Gypona cana* Burm. May to October; not uncommon.

310. *Gypona angulata* Spangb. Alpine and Grossmont; May to October.

311. *Xerophloea viridis* Fabr. Alpine; June to October; both the grey and green forms.

Subfamily JASSINAE

312. *Uhleriella coquelletti* Van D. Taken in abundance on Arctostaphylos bicolor at East San Diego in May and June, 1913. Less abundant in 1914. Occasional at Alpine and elsewhere.

313. *Huleria 4-punctata* Ball. May to July; generally distributed and not rare.

314. *Aligia inscripta* Van D. May and June; not uncommon.

315. *Aligia sp.* Abundant on sage brush (Artemesia) on the hills near the Scripps Institution at La Jolla, June to September.

316. *Mesamia straminea* Osb. Foster and Mussey's, April and May. Pine Hills in October.

317. *Platymetopius nigriviridis* Ball. Swept from grass in Balboa Park, San Diego, Febr. 9th, 1913.

318. *Platymetopius majestus* Ball. Lives on Heteromeles; Alpine, June; The "Willows," October, with the young; Torrey Pines, July.

319. *Platymetopius elegans* Van D. On oaks, March to October; young in May. I took one example at Sevenoaks, Fla., in May, 1908.

320. *Platymetopius acutus* Say. May, common.

321. *Platymetopius acutus* var. *dubius* Van D. Not uncommon of the chaparrel at Alpine and elsewhere.

322. *Platymetopius slossoni* Van D. Mission Valley at San Diego, April; Cuyamaca Mts. in October on Rhus diversiloba.

323. *Platymetopius frontalis* Van D. Cuyamaca Mts., near Descanso, October.

324. *Platymetopius nasutus* Van D. Alpine, June; one example.

325. *Platymetopius loricatus* Van D. Mussey's, April 12th, 1914.

326. *Platymetopius irroratus* Van D. Common everywhere, February to June.

327. *Platymetopius fuscifrons* Van D. Alpine and Mussey's April to June.

328. *Deltocephalus cinereus* Van D. San Diego and Alpine, February to May; on grass.

329. *Deltocephalus melscheimeri* Fitch. La Mesa and Alpine, February to June.

330. *Deltocephalus fuscinervosus* Van D. Abundant everywhere and at all seasons.

331. *Deltocephalus vanduzei* Gill. & Baker. This shining black little species is common here from April to June.

332. *Lonatura minuta* Van D. Coronado, March 11th, 1913; La Jolla, June 25th, 1913; lives on shore grasses.

333. *Euscelis exitiosus* Uhler. Common here as elsewhere throughout the year.

334. *Euscelis striola* Fallen. Low places at East San Diego, April.

335. *Eutettix subaenea* Van D. Taken on willows at San Juan Capistrano and will certainly be found in this county.

336. *Eutettix osborni* Ball. Occurs in great numbers on the Tamarix on the grounds of the Scripps Institution at La Jolla, July to September; a few were taken from the same bush at Alpine in October.

337. *Eutettix tenella* Baker. My records for this species show January, August and December.

338. *Eutettix pannosa* Ball. On black manzanita, Arctostaphylos bicolor, throughout the year.

339. *? Phlepsius personatus* Baker. This species, which I believe I have rightly determined, occurs occasionally throughout the year.

340. *Phlepsius ovatus* Van D. Taken occasionally throughout the year.

341. *Phlepsius extremus* Ball. La Jolla to Alpine; February to July.

342. *Phlepsius utahnus* Ball. La Jolla, one example swept from weeds.

343. *Phlepsius occidentalis* Baker. San Diego and Foster, May, taken on Heteromeles.

344. *Acinopterus acuminatus* Van D. Common everywhere throughout the year. The var. *viridis* Ball is less abundant.

345. *Scaphoideus bicolor* Ball. Alpine and Foster, May to June; not common.

346. *Scaphoideus scalaris* Van D. Common and generally distributed; April to October. Generally beaten singly from

bushes and trees.

347. *Scaphoideus blandus* Ball. Two examples taken at 5000 feet in the Cuyamacas in October.

348. *Scaphoideus scrupulosus* Ball. Grossmont, Alpine, etc., May to July. On Rhus integrifolia.

349. *Scaphoideus opalinus* Osb. One dark example taken in the Soledad Valley at Torrey Pines in June, 1914.

350. *Thamnotettix montanus* Van D. March to July, not uncommon.

351. *Thamnotettix coquilletti* Van D. Pine Hills, October, one example.

352. *Thamnotettix areolata* Van D. Cuyamaca Mts., October, one example.

353. *Thamnotettix heidemanni* Ball. Extremely abundant on a low spreading Polygonum along the coast at La Jolla, May to September. It varies greatly in the amount of red dotting.

354. *Thamnotettix geminata* Van D. April to May. Common on Malvestrum.

355. *Thamnotettix flavocapitata* Van D. La Jolla to Mussey's; April and May.

356. *Thamnotettix kirkaldyi* Ball. Common everywhere, especially on mallows.

357. *Thamnotettix unbricata* Ball. Alpine, one example.

358. *Thamnotettix atropunctata* Van D. Abundant on grasses throughout the year. It varies much in depth of coloring, but usually has a decided reddish cast.

359. *Thamnotettix rapida* Ball. Everywhere on Arcostaphylos bicolor, April to July.

360. *Thamnotettix gutturosa* Ball. With the last but less abundant. This is a stout heavy insect not all characteristic of the genus.

361. *Thamnotettix limbata* Van D. San Diego and Alpine; March to June; not common.

362. *Thamnotettix titusi* Ball. Common on sage brush, April to July.

363. *Thamnotettix vespertina* Ball. With the last and equally abundant.

364. *Thamnotettix visalia* Ball. Mussey's, August.

365. *Thamnotettix gloriosa* Ball. May to July, not uncommon.

366. *Thamnotettix gemella* Ball. Found everywhere on elder trees; April to July.

367. *Chlorotettix unicolor* Fitch. Foster and Descanso; May and October. These do not differ in any way from eastern material.

368. *Neocoelidia candida* Ball. Alpine and Mussey's; April to October; not common.

369. *Neocoelidia reticulata* Ball. San Diego and Alpine; May to October.

370. *Neocoelidia linearta* Baker. Alpine and Pine Hills; October.

371. *Neocoelidia obscura* Baker. La Mesa and "The Willows" near Alpine; February to October.

372. *Neocoelidia barretti* Baker. Found on Rhus laurina at Grossmont, Alpine, etc. A very pretty species that has not before been reported from this country.

373. *Cicadula 6-notata* Ball. Common in suitable locations.

374. *Eugnathodus abdominalis* Van D. San Diego, April.

375. *Dicraneura carneola* Stal. Grossmont and Lakeside, April and May.

376 *Dicraneura cockerelli* Gill. San Diego, May 1st, 1913.

377. *Dicraneura unipuncta* Gill. Foster, Mussey's, Alpine.

378. *Dicraneura tricolor* n. sp.

Black; head, pronotum and scutellum red; elytra golden green. Length 2½ mm.

Vertex strongly produced, more so than in *cockerelli*, distinctly longer than the pronotum; convex, polished; front strongly convex. Pronotum conoidal, polished. Elytra subcoriaceous, nervures indistinct. Last ventral segment of the female nearly triangular, the apex almost acutely produced.

Color black; upper portion of the face, vertex, pronotum and scutellum sangineous; elytra golden green, a little tinged with sanguineous on the base of the costa, inner apical areole with a round black point in most individuals and there is generally a slender yellowish median line crossing the vertex, pronotum and scutellum. Wings faintly smoky hyaline.

Described from thirteen examples representing both sexes, taken at Lakeside and Foster in May.

379. *Empoasca smaragdula* Fall. Alpine; June.

380. *Empoasca obtusa* Walsh. San Diego, Mussey's, Cuyamaca Mts.; May to October, on willows.

381. *Empoasca viridescens* Walsh. Abundant of bush sunflowers, etc., throughout the year.

382. *Empoasca aspersa* Gill. & Baker. Alpine, April; Grossmont and Foster, May; La Jolla, July; San Diego, December.

383. *Empoasca alboneura* Gill. Generally distributed here and moderately common.

384. *Empoasca alboscripta* n. sp.

Size and aspect of *alboneura;* elytra with somewhat vermiculate or areolate white markings. Length 3 to 3½ mm.

Vertex rounding, but little produced; about two thirds the length of the pronotum. Elytra subhyaline toward their apex with strong nervures, last ventral segment of the female long, elliptical, subangular and entire at apex.

Color yellowish-green, becoming darker or olive green above but still with a yellow tint. Elytra usually touched with blueish at base of the clavus and washed with the same color near its apex. Vertex with the median line and a spot either side pale. Pronotum with the median line and a spot behind each eye pale. Scutellum with a pair of pale diverging discal lines which are frequently wanting. Elytra when fully colored with the inner nervures and some connecting spots whitish, outlining in an irregular way several elongated green areoles: four on the clavus of which two are basal, one medial and one apical, and a row of three long ones on the inner margin of the corium. Membrane faintly smoky-hyaline with green nervures and a row of whitish spots on either side of the transverse nervures. Wings hyaline, highly iridescent, the nervures white. Beneath touched with blue-green on the clypeus and legs. Margins of the venter stronger yellow, the tergum lined with dark green.

Described from numerous examples taken at San Diego in April and June and at La Jolla in January, the latter, mostly males, were taken on Ceanothus. This may prove to be but a color variety of *alboneura* but it seems sufficiently distinct. Here the nervures are never evenly white, the pale color seems washed on broadly and irregularly giving the insect a mottled appearance. Those taken later in the season were mostly females.

385. *Empoa querci* Fitch. San Diego, May. Differs from eastern examples in having the tergum mostly black.

386. *Empoa querci* var. 6-*notata* n. var.

Differs from typical *querci* in being tinged with yellowish above. The scutellum is fulvus, the elytra have the commissural nervure and a line along the claval suture yellow, and three pairs of fuscous spots along the commissural margin, the first at the tip of the scutellum, the second on the middle of the claval margin and the posterior pair represents the inner end of the usual transverse row, found in *querci* at the base of the apical areoles; the remainder of this row is poorly defined in this variety.

Described from two males taken at Alpine in June. This is quite distinct from var. *bifasciata* of Gillette and Baker.

387. *Empoa tenerrima* H. S. Two examples taken at San Diego in May and June, and one from Alpine, taken in October. I feel some doubt about this determination.

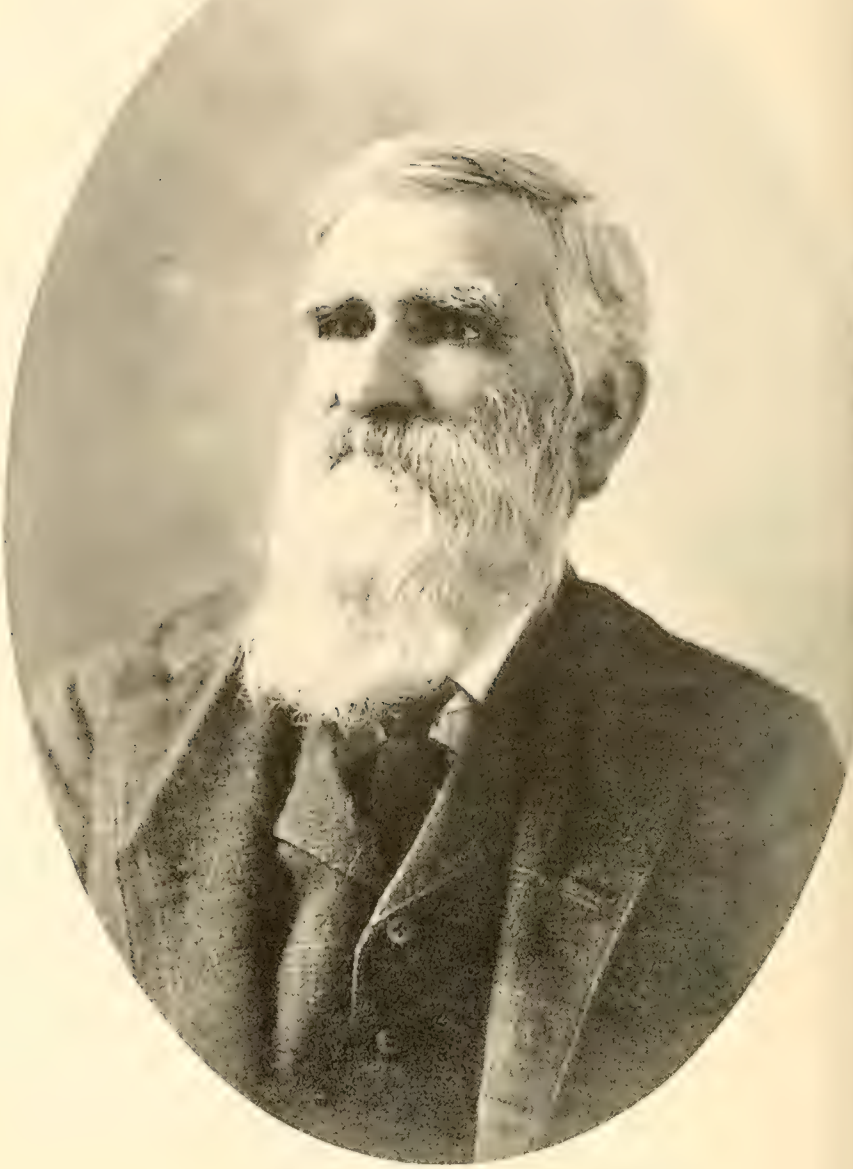
388. *Empoa commissuralis* Stal. San Diego and Cuyamaca Mts., May to October.

389. *Erythroneura obliquua* Say. San Diego, May; Alpine, October. These are pale specimens in which the red is replaced with yellow.

390. *Erythroneura obliquua fumida* Gill. San Diego, May. These also are paler than eastern specimens.

391. *Erythroneura obliquua dorsalis* Gill. Alpine, June 4th, 1913, in two examples the dorsal stripe is blood-red.

392. *Erythroneura comes coloradensis* Gill. Lakeside, May; Alpine, October.



HENRY HEMPHILL, CONCHOLOGIST

IN MEMORIUM—HENRY HEMPHILL.

It is with great sorrow that we have to record the passing away of Mr. Henry Hemphill, a life member of this Society. Mr. Hemphill was born in Wilmington, Deleware, in 1830 and died in Oakland, California, July 24th, 1914, at the age of 84. He came to California about the year 1864 and soon formed an acquaintance with the late R. E. C. Stearns; an acquaintance which ripened into a life long friendship, accentuated by their mutual interest in the study of Mollusks, especially those of the west coast. Mr. Hemphill soon became one of the best authorities in that branch of natural history and material of his collecting is to be found in most of the large museums of the world. Personally Mr. Hemphill was one of the kindest and noblest hearted of men, beloved by all who knew him. His death is a great loss.

Mr. Hemphill was a mason by trade and many of the older San Diego brick buildings are his handiwork. He built for himself a brick house on Third Street, San Diego, where he lived for many years surrounded by his large collection of shells. Finally his daughter prevailed upon him to move to Oakland, California, and live with her and there he spent the last five years of his life. He was a very active man, tireless in the pursuit of his favorite study and only last year, 1913, although eighty-three years of age, he took a vacation trip to the Grand Canyon for pleasure and shell-hunting. In the care of his shells he used arsenic and this poison effected his face causing him great suffering and finally his death.

Mr. Hemphill had a world-wide acquaintance and friendship among those interested in his favorite pursuit and there were few eminent conchologists with whom he was not in correspondence. He was one of the last of the group of naturalists who in the last half of the nineteenth century made the faunal wealth of California so well known.

LIST OF WRITINGS OF HENRY HEMPHILL.

Henry Hemphill—Born 1830—Died 1914. Catalogue land freshwater and marine shells of California and adjacent states. Leaflet.

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——Edible mollusks of Western North America. Zoe II, pp. 134-139, Jy. 1891.

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——Haliotis rufescens Swainson. Nautilus, IV, No. 5, p. 59. Sep. 1890.

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——Note on the Genus Haliotis. Trans. San Diego Society of Natural History, vol. 1, No. 2, 1907.

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The Variation Exhibited by Ancistrodon halys (Pallas) A Pit-Viper Inhabiting the Far East.

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THE VARIATION EXHIBITED BY ANCISTRODON HALYS (PALLAS) A PIT-VIPER INHABITING THE FAR EAST

BY

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SURGEON, UNITED STATES NAVY

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Introduction.

The foundation of Darwin's theory of Natural Selection rests on the fact that variation occurs among animals and plants of the same species. The underlying cause of this variation is absolutely unknown, it is accepted as one of the attributes of a species.

All species are not equally variable. When a genus contains only a few species which are distinct and not subject to much variation the classification is a simple matter. When on the other hand it contains many species and their range of variation is such that frequently a specimen is found whose proper position in the group is uncertain the correct classification of such a genus may be a difficult task. When an involved genus of this latter type is to be studied it is imperative to obtain large series of specimens from widely separated localities and to submit these to a critical examination noting and recording every variation that may be observed. The most important result from a research of this kind is the additional and detailed information on the subject of variability of species in a state of nature.

When a species is disposed to vary to a considerable degree specimens have often been described by different workers as new to science and given a new name. The literature of Systematic Herpetology contains endless errors of this kind. Those made in the last two decades are almost entirely due to a faulty appreciation on the part of mere systematists of the extent to which some forms may vary.

From this it follows that one of the sequels to a study in variation will often be a contribution to synonymy for it will be found that specimens have been described as new that are only variations. When two specimens vary one from the other yet are connected by intermediate examples it demonstrates that they all belong to the same species and therefore these variations in no wise merit specific recognition in the nomenclature.

Were the question of nomenclature purely academic further reference to the subject would be unnecessary, but this assigning of names to each trivial variation and the retaining of these names has two pernicious effects: first, it thwarts and obscures research along the line of variation, and secondly, it impedes the study of the distribution of animals and plants.

The primary object of this contribution is to call attention to the variation which may be exhibited by a single species of serpent.

The data upon which the study of *Ancistrodon halys* (Pallas) is based have been derived from over two hundred specimens; nearly one-half of these have been examined and the records of the remainder compiled from literature.

This species is of considerable interest, for with the exception of *Vipera berus* (Linnæus) 1766, it has a wider distribution than any other Solenoglyph. In fact, in this respect it is equaled by few members of the entire sub-order Serpentes. In general terms it is distributed from the Caspian Sea to Japan, and from Lake Baikal to the Kuen Lung System of Mountains. Definite localities on the outskirts of this area are: to the north, the Yenisei Valley and the Amur Valley; to the east, the Tschargan River and the Talysch District of the Transcaucasus; to the south, the Elburz Mountains, Lob Nor, and the Nan-shan Mountains, and to the west, the Ussuri Province, Japan, and Chekiang Province. The literature contains a few records of specimens from localities beyond this region (1) which are not sufficiently confirmed to be included at the present.

Associated with this wide distribution there occurs a large range of variation. These two factors have been responsible for the several supposed species that have been described in the past and maintained up to the present time. The series of specimens available for study has lead to the conclusion that the synonymy of *Ancistrodon halys* (Pallas) 1776, should include the following:

Ancistrodon blomhoffii Boie 1826, Japan.

Agkistrodon blomhoffii brevicaudus Stejneger 1907 Fusan.

Ancistrodon affinis Gray 1849, type locality unknown.

Ancistrodon intermedius Strauch 1868, Irkutsk.

The prohibitive difficulty of maintaining these as distinct species is due to the fact that when a real museum series

(1) Loo Choo: 1896, Boulenger, Cat. Sn. Brit. Mus. III, p. 526, (A. blomhoffii). 1907, Stejneger, U. S. N. M. Bull. 58, p. 461, (A. blomhoffii affinis.) Formosa; 1863, Swinhoe, Ann. Mag. Nat. Hist. (3), XII, p. 225, (Halys blomhoffii). Hainan: 1866, Bocourt, Nouv. Arch. Mus. Paris, II, Bull. p. 9, (Trigonocephalus blomhoffii).

Since these accounts have been published over three thousand reptiles and amphibians have been added to museum collections from these localities without additional specimens of this form having been taken

is gone over it is regularly found to contain many specimens which are impossible to determine according to the definitions given. The average of a set of examples from Central Asia and Eastern Asia, or from China and Japan, differs sufficiently to have justified the earlier authors in establishing the several species, but, the number of specimens found with intermediate characters absolutely precludes the possibility of retaining these names as indicating valid species.

In reviewing the literature one may read in the volume by Strauch, "So halt es nicht ganz leicht, ein Merkmal zu finden, durch welches sie fur alle Falle mit Sicherheit von einander zu unterscheiden waren." (1). Boulenger in speaking of *A. intermedius* states that it "Agrees in most respects with *A. halys*, but the snout is not at all turned up at the end, as in *A. blomhoffii*"; and *A. blomhoffii* he mentions as "Closely allied to *A. halys*, with which it agrees in most respects, but the snout not turned up at the end, and scales more strongly keeled" (2). Professor Leonhard Stejneger writes: "It will be seen that a considerable amount of intergradation occurs. Thus it would be impossible to say to which of the three forms (Tables II, III, or IV) a specimen with 151 ventral and 45 subcaudals were to be referred unless it had 8 supralabials, * (3). From this it may be inferred that these authors have felt the inherent difficulty of separating these forms.

When it is admitted that one form agrees in most respects with another, that it is difficult to find a character that will separate them, and that considerable intergradation occurs, the probability is that but one valid species is under consideration. It is also fairly certain that further collecting along the zones of contact of the two supposed forms will bring to light many specimens with the intermediate characters necessary to cement the two groups into a single species that henceforth will be of increased interest owing to its range of variation. This, it is believed, is the status of *Ancistrodon halys*.

Variation In Number Of Vertebrae.

There are many members of the sub-order Serpentes that show a vastly greater variation in the number of verterbræ than do any of the other animals in the entire Phylum of Vertebrata. An extreme example of this nature is the Marine Serpent *Distira fasciata* (Schneider) 1799, the number of

(1) 1873 Strauch, Schl. Russ. R. p. 235.
(2) 1896 Boulenger Cat. Sn. Brit. Mus. III, pp. 525-526.
(3) 1907 Stejneger, Bull. No. 58, U. S. N. M. p. 452.

whose body vertebræ alone may vary as much as one hundred.

When investigating this character one should record the number of body and caudal vertebræ separately and obtain their sum.

Variation In Sum Of Gastrosteges And Urosteges

The number of verterbræ in terms of gastrosteges and urosteges is subject to a fairly wide range, being from 170 to 226, a difference of 56. Specimens from Siberia possess the highest, those from the Yangtse Valley the lowest, and those from Korea and Japan the intermediate counts.

	Examples.	Minimum.	Maximum.	Average.
Range of variation	152	170	226	190
Range in Mainland specimens	109	170	226	193
Central Siberia	29	195	226	214
Eastern Siberia	27	191	202	195
Korea	24	175	200	187
China	29	170	185	178
Range in Island specimens	43	179	200	187
Hokkaido	6	183	195	188
Hondo	23	179	200	191
Shikoku	2	187	187	187
Hachijoshima	2	185	185	185
Awaji	1	190	190	190
Kiushu	1	184	184	184
Ikishima	5	182	188	185
Tsushima	3	182	192	188

The range of variation in the mainland examples being from 170 to 226 and of the Island examples from 179 to 200, it is evident that the range of the mainland specimens widely overlaps that of the island specimens.

Variation In Gastrosteges.

Every effort should be made to have the gastrostege count an index to the number of the dorsal vertebræ. To further this aim it is necessary to ascertain which shield corresponds with the first link in the vertebral column. A few dissections have shown the most approximate estimate that can be made without actually opening the neck is to reckon as the first gastrostege the first shield that is of the same width as the entire series; it is usually further characterized by being colored like the rest of the gastrosteges and not white as are the throat shields.

The shields between the anterior pair of geneials and the first gastrostege are referred to as gulars; they are of two types, paired and azygos. Note should be made of their number in the record of each specimen, as this will tend to fix the first gastrostege, this being the shield from which are started many of the counts.

If the locality of each specimen be plotted on squared paper, due regard being taken of the gastrostege and urostege

count, a diagram results that will materially aid in presenting the facts. (Vide appendix).

It may be seen at a glance that the number of gastrosteges varies from 132 to 179, thus indicating a difference of 47 somatic vertebræ. Further inspection evidences that the specimens from the islands have the shortest bodies. If these are compared with specimens from Central Asia the opposite extreme of the distribution it is seen that they do not overlap in respect to this character, the gap of one vertebra existing at the numbers 146-147. However, in the immediate vicinity of this discrepancy there are ample records from the intervening mainland, that is the Ussuri Province and Korea. It is clear that the affinities of the Japanese specimens are to be found among those from China. The final point to be derived from this diagram is the fact that no lines of demarkation or grouping of the specimens exist. Such lines would necessarily be found were we dealing with distinct species, while their absence is proof that but one species is under consideration.

Variation In Urosteges.

The urosteges exhibit a wider range of variation proportionately than the gastrosteges, the count being from 30 to 58, a difference of 28 caudal vertebræ.

	Examples.	Minimum.	Maximum.
Total Range	182	30	58
Mainland Specimens	138	30	53
Central Asia	58	32	53
Eastern Siberia	27	36	51
Korea	24	31	52
Yangtse Valley	29	30	43
Island Specimens	44	41	58
Hokkaido	6	41	52
Hondo	24	45	58
Hachijoshima	2	46	46
Awaji	1	50	50
Shikoku	2	45	47
Kiushu	1	48	48
Ikishima	5	41	50
Tsushima	3	44	46

It occasionally happens that a few of the urosteges are entire. These undivided shields are regularly found close to the base of the tail.

	Examples.	Normal	With a few entire Shields.
Total Number	61	51	10
Ussuri Province	3	2	1
Korea	20	17	3
Shanghai	20	16	4
Japan	18	16	2

Variation In Scale Rows.

Over fifty specimens have been studied for this character. They include material from seventeen localities in the eastern

region of the distribution. There is a wide range in the maximum number of scale rows around the anterior part of the body. The normal is 21; it may be increased to 23 and to 25, or it may be decreased to 19 rows. We have been taught by Doctor Ruthven that for the purpose of comparing one set of observations with another the scale rows must be given permanent numbers, also, that it is necessary to select a specimen having the maximum number of rows for the species. In this case it is one with 25 rows, and these are numbered I to XII, counting from the outer row inward to the median. In all specimens the maximum count is on the anterior part of the body and diminishes posteriorly. This decrease is due to the loss of definite scale rows, exactly as Doctor Ruthven has shown occurs in the genus *Thamnophis* (Fitzinger) 1843.

In *Ancistrodon halys*, the sequence of suppression is as follows:

25 rows, V row suppressed, leaving—
23 " VI " " "
21 " IV " " "
19 " VII " " "
17 " , which are continued to the vent

The normal squamation is where there are 25 rows anteriorly with the V row suppressed leaving 23 rows; next the VI row is suppressed leaving 21 rows; then the IV row is suppressed leaving 19 rows; finally the VII row is suppressed, leaving 17 rows which are continued without further loss to the base of the tail. The scale formula for this type would be written:

25-23-21-19-17 (-V-VI-IV-VII).

In a normal specimen the number of scale rows, the sequence of suppression, and the gastrostege level on the right and left sides of the body at which the rows terminate, may be thus expressed:

Museum	Locality	Sex.	G.	25-V.	23-VI.	21-IV.	19-VII.	17-Cont.
U. S. N. M. 34024....	Yokohama	♂	141	7 8	14 14	101 103	136 130	....

In specimens with the same number of scale rows there is a difference in the distance to which the suppressed rows extend down the body. From this have resulted the different accounts that are found in literature of the number of scale rows around the body. There are records of specimens with 25, 23, 21, and 19 rows. It is evident that a specimen with 25 rows anteriorly, and the V row continuing down the body to the level of the 80th gastrostege would be recorded as

having 25 rows, whereas one with 25 rows anteriorly and the V row terminating well forward at the level of the 10th gastrostege would be recorded as having 23 rows. Another specimen with 25 rows anteriorly in which both the V and VI rows terminate a little behind the neck would be recorded as having 21 rows.

The point involved may be illustrated by the detailed scale formulæ of two specimens in the United States National Museum. These are mentioned in the Herpetology of Japan by Professor Leonhard Stejneger, the male as having 23, and the female 21 scale rows.

Museum No...	Sex.	Rows.	25-V.	23-VI.	21-IV.	19-VII.	17-Continued.
34040	♀	23	17-12	70-79	103-102	Continued.	
34024	♂	21	7-8	14-14	101-103	136-130	Continued.

The scale rows may further vary, not only in the maximum number that occurs anteriorly, but also in the minimum count that is found towards the base of the tail. This variation combined with the difference in the level to which a suppressed row extends down the body, gives rise to two types of scale formulæ:

25-23-21-19-17 (-V-VI-IV-VII)

25-23-21-19 (-V-VI-IV)

Detailed records of a few specimens possessing these different types may now be reviewed.

FORMULA 25-23-21-19-17 (-V-VI-IV-VI).

Museum.	Locality.	Sex.	G.	25-V.	23-VI.	21-IV.	19-VII.	17-Cont.
Cal. Ac. Sci. 31511	Korea	♂	148	14-20	98-90	107-107	140-134	....
U. S. N. M. 34024	Hondo	♂	141	7-8	14-14	101-103	136-130	....
Cal. Ac. Sci. 26732	Hokkaido	♂	136	6-5	11-11	106-110	132-132	....
Cal. Ac. Sci. 26142	Ikishima	♂	138	9-9	15-12	78-78	109-110	....
Cal. Ac. Sci. 14615	Shanghai	♀	145	9-9	56-47	108-106	124-125	....

FORMULA 25-23-21-19 (-V-VI-IV).

Museum.	Locality.	Sex.	G.	25-V.	23-VI.	21-IV.	19-Continued.
U. S. N. M. 21866..	Shikoku	♀	137	9-9	68-67	111-114	....
U. S. N. M.	Shikoku	♀	140	7-7	12-12	114-109	....
Cal. Ac. Sci. 16096.	Hondo	♀	142	5-5	9-8	101-103	....
U. S. N. M. 23436..	Hokkaido	♀	139	9-7	14-15	116-116	....
Cal. Ac. Sci. 26141.	Ikishima	♀	140	13-14	72-70	102-102	....

FORMULA 23-21-19 (-VI-IV).

There are two specimens in the Vladivostok Museum. Nos. 515 and 522, from the Ussuri Province with this formula. The 19 row zone begins at the level of the 10th gastrostege. These are the only specimens recorded with this reduced

number of scale rows about the anterior part of the body.

On the mainland the prevailing formula is 25-23-21-19-17, being present in about 66 per cent of the specimens. In the islands the majority have the count of 25-23-21-19, occurring in about 80 per cent. These differences show that in the island specimens, associated with the shorter body, there is a tendency for the VII row to be continued and for the zone of 19 rows to remain intact to the base of the tail.

These counts do not indicate such a radical difference as is so often the case between valid species. They merely indicate a difference in the distance down the body that these suppressed scale rows extend.

Neither the number of scale rows, nor the distance to which they extend down the body, in any way effects the sequence of suppression; this, barring abnormal individuals, is definitely fixed for each species. Several hundred species have been investigated for this character, which when better known will prove of high value in confirming or establishing relations between genera.

The greatest range of variation that is known in the number of dorsal scale rows in a single species is found in *Thamnophis ordinoides* (Baird and Girard) 1853. (1)
There being recorded ten distinct formulæ:

21-23-21-19-17
21-19-17
19-21-19-17
19-21-19-17-15
19-17
19-17-15
19-17-15-13
17-19-17-15
17-15
15-17-15

In this Garter-Snake from the Pacific Coast of North America the sequence of suppression is (-V-VI-IV-VII). It is a matter of much interest to note that this sequence is the same as that found in *Ancistrodon halys*. In these two species there must be some analogous underlying cause that brings about a reduction in the number of scale rows around the body by an identical sequence of suppression.

(1) 1914, Thompson, Proc. U. S. Nat. Mus. Vol. 47, p. 351.

Central Asia.

The data for this table has been compiled from the Snakes of the Russian Empire by Strauch, the Catalogue of the Snakes in the British Museum by Boulenger, and the Herpetology of Japan by Professor Leonhard Stejneger.

		Per cent.
Total Number of Specimens	50	
25 Scale Rows	2	4
23 " "	42	84
21 " "	6	12
19 " "	0	0

In comparing this table with those that follow it will be noted that the serpents from Central Asia have the highest scale row count, the normal being 23 rows, furthermore it is only from this region that specimens with 25 rows have been reported.

Eastern Siberia.

The Khingan Range of Mountains is regarded as the boundary between Central and Eastern Siberia. The records in literature, notes on eleven specimens in the Vladivostock Museum, and two collected in 1907 afford the following table:

		Per cent.
Total Number of Specimens	30	
25 Scale Rows	0	0
23 " "	20	66 2-3
21 " "	8	26 2-3
19 " "	2	6 2-3

Korea.

The records in literature, and notes from a few other specimens are combined in the following table:

		Per cent.
Total Number of Specimens	25	
25 Scale Rows	0	0
23 " "	5	20
21 " "	20	80
19 " "	0	0

China.

The records in the Catalogue of Snakes in the British Museum and notes from twenty examples collected at Shanghai compose the following table:

		Per cent.
Total Number of Specimens	29	
25 Scale Rows	0	0
23 " "	3	10 1-3
21 " "	26	89 2-3
19 " "	0	0

Japan.

There are available in literature and from a few field notes the following records of the maximum number of scale rows around the anterior half of the body:

		Per cent.
Total Number of Specimens	46	
25 Scale Rows	0	0
23 " "	8	17 1-2
21 " "	38	82 1-2
19 " "	0	0

The two types are distributed among the different islands as follows:

Islands.	23 Rows.	21 Rows.
Hokkaido	0	6
Hondo	2	22
Hachijoshima	0	0
Awaji	0	1
Shikoku	1	1
Kiushu	0	1
Yakushima (1)	1	0
Tanegashima (1)	1	0
Ikishima	3	2
Tsushima	0	3
Total	8	38

Variation In Physiognomy.

There are marked differences in the profile and contour of the head of certain specimens. The snout may be short and decidedly tilted at the tip. This is very striking but is not associated with any other constant character. Specimens with the turned-up snout have even been captured in the same thicket with the commoner variety having the flat head. The other character, the contour of the muzzle, varies in being more acute in some specimens than in others. With just a few specimens at hand it would not be unreasonable to assert that two distinct species were under consideration. But, after examining a large series and finding every combination of these characters one is convinced of the specific identify of the snakes. From this it appears that not only may a single species of serpent vary in details of squamation, but also structurally to the extent of producing a marked difference in its external anatomy.

Structural variation in the size of the eye is known to exist among specimens of *Thamnophis parietalis* (Say) 1823, taken in California. The extremes are astonishingly wide apart, yet a perfect series of intermediate diameters may be found.

Variation In Prefrontals.

There is considerable variation in the shape of these shields. They vary from being as long as wide to a shorter condition in which the length is but 2-3 of the width. The specimens with the shorter shields have the shorter and broader snout. Two percent of the examples studied showed the tendency to fragmentation of this shield.

Variation In Frontal.

In the majority of specimens from Shanghai the frontal shield is about 1 2-5 times longer than broad. In all the

(1) 1903, Wall, Proc. Zool. Soc. London, p. 102.

Japanese examples the proportion is less than 1 1-5. In those from Korea there occurs about an equal number of the narrow and broad shapes. These variations in the shape and length of the prefrontal and frontal shields are seen in specimens that have a decidedly different physiogonomy.

Variation In Postoculars.

The only variation these shields offer is where the normal number of two is increased to three. This is regularly brought about by a division of the upper part of the normal inferior postocular. Occasionally this shield is merely dented at the line where the separation occurs.

	Examples.	Normal. 2	Asymmetrical. 2-3	Increased. 3
Total Number	76	66	7	3
Ussuri Province	2	2	.	.
Korea	25	16	7	2
Shanghai	20	19	0	1
Japan	29	29		.

It will be noted that the specimens from the mainland are the only ones to show this variation.

Variation In Temporals.

The region between the large smooth temporal shields and the parietals is covered with a set of small scale-like shields that are frequently keeled. These may be referred to as supratemporals. The anterior of these lies just behind the superior postocular. It is normally single; the only variation is where it is double, the additional shield being formed by an horizontal division.

	Examples.	Normal. 1	Asymmetrical. 1-2	Increased. 2
Total Number	60	49	6	5
Ussuri Province	2	11	.	.
Korea	20	15	3	2
Shanghai	20	19	1	.
Japan	18	14	2	2

Occasionally the anterior temporal shield is fragmented, the anterior inferior angle being separated by a suture. In a few cases the middle temporal shield was horizontally divided. The posterior temporal is subject to much variation in size and shape.

The middle temporal shield is usually not as deep as the anterior, but in many specimens the vertical diameters of the two shields are equal.

		Middle Temporal Shield.	
	Examples.	Lower than Anterior.	Equal to Anterior.
Total Number	60	46	14
Ussuri Province	2	2	.
Korea	20	12	8
Shanghai	20	14	6
Japan	18	18	.

Variation In Supralabials.

The normal condition is to have 7 supralabials with the III entering the eye. When the number is increased to 8 it is due to the normal V shield being divided. When the count is decreased to 6 it is not known what shields are fused or suppressed to bring it about.

	Examples.	Normal. 7	Asymmetrical. 7-8	Bilateral. 8
Total Number	118	97	13	8
Central Asia	10	2	3	5
Ussuri Province	13	7	4	2
Korea	25	21	3	1
China	29	27	2	.
Japan	41	40	1	.

It is evident that in specimens from the mainland along with their larger size there is an increase in the number of scale rows around the anterior half of the body and a tendency for an increase in the number of supralabial shields.

Variation In Infralabials.

The normal condition is to have 10 infralabial shields. Where the number is increased to 11 it is due to the normal VII shield being divided. Where the count is decreased it is usually due to the fusion of the normal II and III shields, but may be brought about by the fusion of the I and II, or the VII and VIII shields.

	Examples.	Increased. 11	Asymmetrical. 11-10	Normal. 10	Asymmetrical. 10-9	Decreased. 9
Total Number	59	5	16	31	4	3
Ussuri Province	2	.	.	1	1	.
Korea	19	2	5	7	2	3
China	20	2	3	15	.	.
Japan	18	1	8	8	1	.

It may be instructive to compare the count of the labial shields in *Hebius vibakari* (Boie) 1826, (1) which occurs in the Ussuri Province, Korea, and Japan.

The supralabial shields are normally 7, with the third and fourth entering the eye. When the number is increased to 8, it is by the addition of a shield between the normal II and III, and is referred to as IIa; in actual counting the fourth and fifth enter the eye. When the number is decreased to 6, it is due to the fusion of the normal III and IV shields; by actual count it is the third that enters the eye.

(1) 1913, Thompson, Proc. Zool. Soc., Loudan II, p. 424.

These variations may be represented in this manner:

The frequency of these variations in terms of percentage is as follows:

Supralabials.	Mainland, 9 sp.	Island, 30 sp.
5-6	11.1	. . .
6	11.1	. .
6-7	11.1	....
7	66.6	76.6
7-8	....	16.6
8	....	6.6

The infralabial shields are normally 8. When the number is increased to 9, it is by the addition of a shield between the normal VII and VIII; this added shield is referred to as VIIa.

Infralabials.	Mainland, 4 sp.	Island, 9 sp.
8	100 per cent	44.4
8-9	....	44.4
9	....	11.1

In this species when a change from the normal occurs it is brought about by the addition or loss of different shields than is the case in the genus *Thamnophis*, (Fitzinger) (1).

Supralabials.	Trop. vabakari.	Thamnophis.
7 increased to 8	IIa added.	IIa added
7 decreased to 6	III-IV fused	VI suppressed
Infralabials.		
8 increased to 9	VIIa added.	IIIa added.

Summary Of Variation.

The tabulated summary again emphasises the affinity between the Japanese and Chinese rather than between the Japanese and the Korean specimens. There is a fairly well marked line of demarkation between the Reptile and Batrachian Faunas of Korea and Japan. This line runs parallel with the Korean Strait, passing to the east of Quelpart and Tsushima Islands.

(1) 1908, Ruthven Bulletin No. 61, U. S. National Museum, p. 23.

The affinity between the Chinese and the Japanese specimens may be correlated with the past geology of the region. Suess has shown that the mountain range in the lower limb of the Japanese Island arc bends sharply to the west and in former periods it was continuous with the Tsin-Lin Mountains in Central China. It will be remembered that near these Chinese Mountains and in the lower limb of the Japanese arc are the only localities in which is found *Megalobatrachus japonicus* Schlegel, the giant salamander of the Far East.

TABULATED SUMMARY. (1)

	Scale Rows				Postoculars			Supratemporals			Supralabials				Infralabials			
Locality	25	23	21	19	2	2-3	3	1	1-2	2	7	7-8	8	11	11-10	10	10-9	9
Central Asia	4	84	12	..	?	?	?	?	?	?	20	30	50	?	?	?	?	?
Eastern Siberia	..	66	26	6	100	...	..	100	...	..	54	31	15	..	..	..	50	50 ..
Korea	..	20	80	..	64	28	8	75	15	10	84	12	4	10	26	37	10	16
China	..	10	90	..	95	..	5	95	5	..	93	7	..	10	15	75	....	..
Japan	..	17	83	..	100	...	..	78	11	11	97	3	..	5	44	44	5	..

In reviewing this table it appears there is not the slightest tendency for these variations to be grouped, or for one independent set to be associated with another. It is not even possible to correlate them with a given distribution. On the other hand it is not to be inferred that they occur entirely at random. Each series of specimens from a definite region has its own average in respect to a given character, and this average may differ when compared with figures derived from a set of specimens captured in another region. The final deduction is that these variations cannot any longer be employed to establish and maintain valid species; that is, species that will conform to the immortal definition given by Gunther in the Preface to Volume VIII of the Catalogue of the Fishes in the British Museum. This reads: "*I consider a species to be well established only when it is founded on characters which, from an examination of numerous examples are found to be permanent, not subject to gradual variation, and not dependent on season, sex, or age—or which are known to be so from the examination of allied forms.*"

(1) To facilitate comparison the entries are in terms of percentage of the total number of specimens from each locality.

Position Of The Viscera.

The external landmarks of the principal viscera, in terms of gastrosteges are as follows:

Sex	♂	♂	♂	♂	♀	♂	♀	♂	♀
Scale rows	25-17	25-19	25-19	25-17	25-17	25-19	25-15	25-17	25-17
Gastrosteges	134	140	140	139	139	143	143	154	153
Heart apex	47	47	41	45	46	47	45	52	49
Liver, tip	47	51	45	47	50	50	44	53	52
Liver, end	75	78	83	81	79	82	78	83	85
Gall bladder	83	88	90	86	87	93	89	96	99
Kidney, right, tip..	105	111	112	110	112	107	122	119	127
Kidney, right, end.	123	127	123	129	130	134	134	144	147
Kidney, left, tip..	107	114	115	114	115	115	124	122	129
Kidney, left end..	125	130	132	131	130	135	135	143	144
Cal. Ac. Sci., Museum No.....	26732	16097	14611	14621	14609	31538	31507	31540	31542

In this species there is no definite relation between the level at which the scale rows are suppressed and the underlying viscera. The body begins to taper noticeably posterior to the liver and in the majority of specimens the last two rows to be suppressed terminate between the level of the gall bladder and the tip of the right kidney.

The sex of the specimen to a marked degree influences the position of the viscera. In the male the heart is a trifle further caudad, there is a wider space between the heart and the liver, the anterior kidney is longer and there is much less space between this organ and the liver. It will be seen that in the female the differences tend to afford more space in the abdominal cavity for carrying the young.

Alleged Occurrence In The Loo Choo Islands.

The presence of this serpent in the Loo Choo Group is open to a just suspicion. The type specimen of *Trigonocephalus affinis* (Gray) 1849, British Museum "x," is without a locality label. It in no respect differs from those found in Japan. British Museum specimen "d", reported from Okinawa, is also typical of the Japanese average. The two specimens recorded from Yae Yama, United States National Museum Nos. 34038 and 34039 likewise differ in but one slight abnormality from typical Japanese examples. The color of both, and especially No. 34039, is nearly ruined by exposure to strong light; each specimen is slightly darker on the inner and less exposed sides of the coils as they repose in a jar.

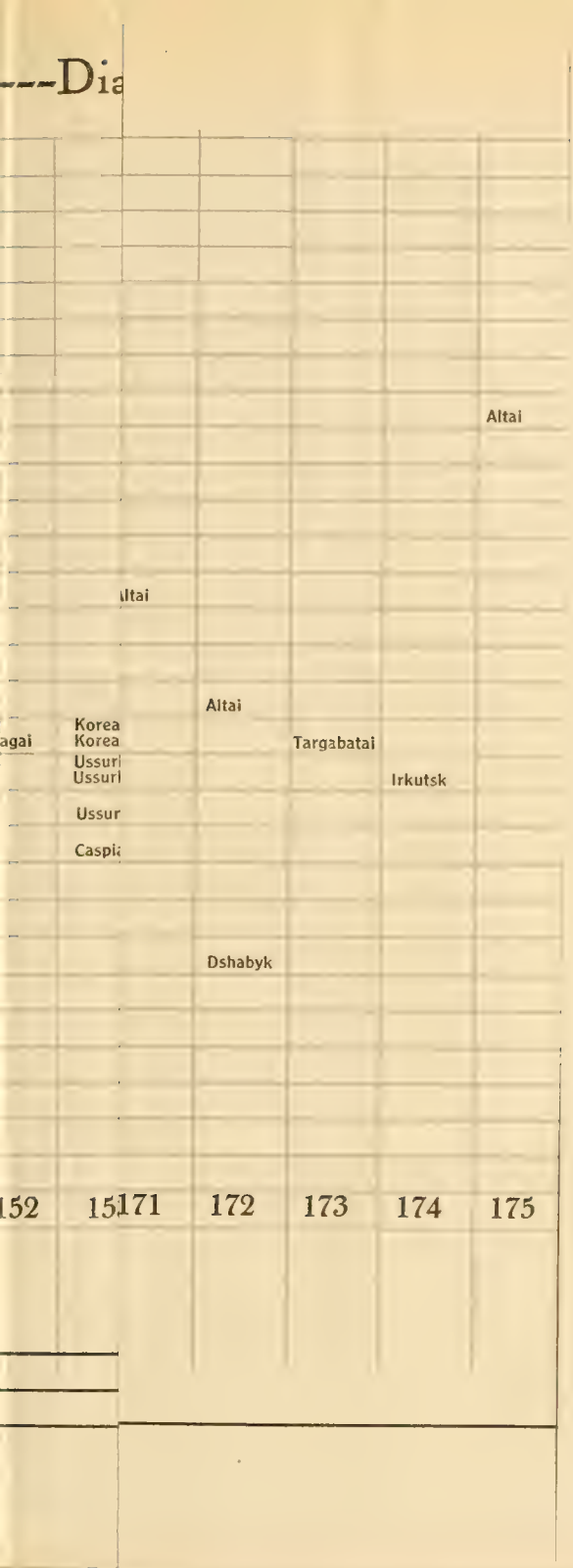
Details of the scale formulæ of the two specimens are as follows:

U. S. N. M.	Sex.	G.	25-V	23-VI	21-IV	19-VII	17-Continued
34038	♂	138	5 5	7 7	91 91	117 121	....
34039	♂	137	3 8	6 8	76 82	119 123	....

It will be noted that this formula 25-23-21-19-17, predominates in island specimens to the north of Yokohama, while the 25-23-21-19 type is the prevailing one in Southern Japan.

The occurrence of the few faded specimens in collections from the Loo Choo Islands may readily be accounted for if the gastromomic use to which they are put is taken into consideration. There is an oriental proverb to the effect that what cannot be eaten may still be made into medicine. The peasants of China credit this serpent with valuable therapeutic properties, and it has even been seen for sale in the Chinatown of San Francisco. Among the Japanese it is extensively used as an alterative, especially by the young men in the spring time. It is to be seen dried or preserved in sake, the national wine, on the counter of any chemist shop, especially inland and away from the Treaty Ports. It is therefore logical to assume that these specimens were invoiced to the Loo Choo Islands as a part of a consignment of drugs, and subsequently were gathered in by a native collector. Furthermore, there are over two thousand specimens of Reptiles and Batrachians from the Loo Choo Islands in museums; these are known to include fifteen species of serpents, all of which with one exception are strictly endemic. This exception is *Typhlops braminus* (Daudin) 1803, an archaic form and distinguished by having the widest distribution of any of the Typhlophidae, it being found from Persia in the west to Guam in the east.

U. S. NAVY RECRUITING STATION
SAN DIEGO, CALIFORNIA, May 26, 1916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APPENDIX---Diagram Illustrating Variation in Gastrosteges

EXCURSION IMPRESSIONS

TRANSACTIONS SAN DIEGO SOCIETY OF NATURAL HISTORY
Vol. 2, No. 3. 1916. Pp. 77

Excursion Impressions

By Frank Stephens

The Pacific Division of the American Association for the Advancement of Science held its annual meeting in San Diego, California, August ninth to twelfth, 1916. Among the excursions offered visiting members and their friends was one arranged by the San Diego Society of Natural History and the Scripps Foundation to the border of the Colorado Desert, a two-day trip by automobile. Its object was to afford visitors an opportunity to see the changes in the plant life from the sea coast to the arid region east of the mountains. The trip was too hurried for any detailed work, and as it was the height of the dry season most of the annual plants were ripe and dry.

Going out the usual stage route to Imperial was followed. The return was over the same route as far as Campo, where we turned northward to Pine Valley and Descanso and to San Diego, by a route north of the one followed going out. The length of the round trip was about 220 miles. The accompanying sketch map will give the details of the route followed.

The start from San Diego was made at 8 a. m., August 13th, with thirty-two members and their friends in six automobiles. Lunch was eaten under the oaks near Campo. In the afternoon the party went to the edge of the Colorado Desert, and returned at dusk to the crest of the precipitous eastern slope of the mountains, where camp was made under the stars, as in this sparsely settled region there was not sufficient hotel accommodations for so large a party. Blankets and provisions for the party were taken along in an auto-truck. The weather was cool for the season, and, except a rather strong breeze during the night, it was very pleasant. The thermometer at camp was 76° at sunset and 65° at sunrise. At noon of the 14th, lunch was eaten under the pines in Pine Valley, and the party returned to San Diego before sunset.

The principal interest of the trip was botanical. It was the wrong season to find many plants in flower, but quite a number of shrubs and perennial plants were in bloom. Butterflies and other insects were scarce. Few birds and mammals were seen, partly because of the disturbance made by the autos. Dr. Grinnell and I put out seventy-five small traps at the night camp and caught eighteen small rodents, of five species. But one geologist was with the party.

I asked several members of the party to write their impressions of what they saw on the trip, and their accounts follow. It is interesting to have accounts of the same trip from different view points.

The approximate altitudes of places on the route followed are: Lemon Grove, 500 feet; Jamul, 1000; Dulzura, 1100; Cottonwood Creek, at the crossing, 875; Mt. Tecate, 3900; Potrero, 2300; Campo, 2550; Peninsular divide, 4000; Jacumba, 2900; our night camp, 3400; edge of the Colorado Desert, 1000; Pine Valley, 3700; Descanso, 3500; Cuyamaca Peak, 6500; Alpine, 1900; El Cajon, 500.

By Dr. Forrest Shreve.

The Desert Laboratory, Tucson, Arizona.

A rapid journey made through an interesting stretch of country awakens a constant desire to stop, linger and examine the natural phenomena in greater detail. It is often extremely vexing to feel it necessary to push forward under these circumstances, but in the very rapidity of such a trip there is a value which it is impossible to overlook. A rapid journey through a diversified region keeps the observer from being overwhelmed with new details and leaves his mind free to receive the larger impressions. In the excursion made by members of the Western Society of Naturalists and the Ecological Society of America, under the auspices of the San Diego Society of Natural History, there was opportunity for a considerable examination of details at the same time that the journey of 200 miles, covered in two days, was sufficiently rapid to give the participants a vivid series of pictures of very dissimilar regions. To leave the humid Pacific shores in the morning and to witness the sunset on the arid sands of the Colorado desert on the same day is an experience which can not fail to linger in the recollections of all who have enjoyed it.

The course of the excursion lay east from San Diego, through the complex and crowded foothills to Campo, then through a series of valleys lying between 3500 and 4000 feet, to a rather abrupt edge, from which it was possible to overlook the Imperial Valley. From this place the route descended rapidly to the edge of the desert, at about 1000 feet. In the vicinity of San Diego much of the country has been altered by cultivation, but the greater part of the journey lay through virgin country.

From San Diego to the drainage divide of the Cuyamaca Mountains, east of Campo, the prevailing vegetation is chaparral, in which *Adenostoma fasciculatum* is the predominant plant. This type of vegetation, so characteristic of Southern California, here reaches a height of about 5 to 6 feet, forming dense thickets in some places and low or open stands in others. Among the commonest associated plants are *Rhus integrifolia, Eriodictyon crassifolium* (yerba santa), *Audibertia polystachya* (white sage), and *Eriogonum fasciculatum*. In the flood-plains of the larger streams are to be seen large trees of *Quercus chrysolepis* and *Platanus racemosa*, together with species of *Sambucus, Salix, Populus* and the climbing *Vitis girdiana*. The narrow dales, or valleys devoid of streamways, appear to have been originally unoccupied by either trees or chaparral, although it is now difficult to be sure of such a matter.

There is little change in the character of the chaparral until an

elevation of 1500 feet is reached. Up to this point the hills show frequent breaks in the continuity of their cover, and large groups of *Opuntia littoralis* are common, as well as the less conspicuous cylindropuntia, *O. prolifera*. Above 1500 feet the chaparral is practically unbroken, and the number of species growing with *Adenostoma* is increased by the addition of *Rhus ovata*, *Quercus dumosa*, *Ceanothus tomentosus* and *C. eglandulosus*, *Arctostaphylos tomentosa* (manzanita), and *Cneoridium dumosum*. The monotony of this assemblage is relieved here and there by individuals of *Yucca whipplei*, or by the occurrence of *Adenostoma sparsifolium*, which is taller than its common congener and is particularly conspicuous when densely loaded with its small white flowers.

A stop was made to examine the small colony of Tecate Cypress, a tree which appears to be endemic to this locality, although closely related to *Cupressus goveniana*. After having visited on the previous day the only mainland station for *Pinus torreyana*, near La Jolla, it was very instructive to see another case in which plants of ancient lineage have been stranded and localized by the crustal movements of the Pacific coast line and by the climatic changes which have undoubtedly accompanied them.

After reaching Campo we passed for more than 20 miles through rolling country in which low granitic ridges alternate with alluvial valleys. The ridges and hills still bore chaparral, and the valleys were mostly in cultivation, although a few untouched ones sufficed to show that their original vegetation had been pure stands of *Artemisia tridentata* (sage-brush). On reaching the vicinity of Jacumba, 25 miles east of Campo, the complexion of the vegetation began to change very rapidly. Both species of *Adenostoma* were left behind and the first individuals of *Covillea tridentata* (creosote bush) and *Prosopis glandulosa* (mesquite) were seen. In short the chaparral had been passed and we were in what might be termed a "bush desert". Many shrubs which had been infrequent for several miles now became more common, as *Simmondsia californica* (jojobe), *Prunus ilicifolia* (desert plum), *Juniperus californica* (juniper) and *Ephedra;* while *Quercus dumosa* was replaced by *Q. turbinella*. Representatives of the chaparral were still present in *Audibertia polystachya*, *Cneoridium dumosum* and *Arctostaphylos tomentosa*, while the desert aspect of the landscape was heightened by numerous striking cacti and by the shrubs *Atriplex*, *Lycium*, and *Krameria*.

The spot selected for our camp was doubly enjoyable by reason of the magnificent outlook over the desert below, and on account of the natural botanical garden by which we were surrounded. At an eleva-

tion of about 3000 feet, in the midst of large granite boulders, we found ourselves in an open stand of desert bushes, cacti of several types, and conspicuous blooming plants of *Nolina bigelovii*. Throughout the southwest the finest displays of cacti, and the richest vegetation and flora in general, are to be found in just such situations as this, rocky and slightly above the general level of the desert valleys. Here at our camp were to be seen the columnar *Echinocactus cylindraceus*, often six feet in height, the much-branched *Opuntia acanthocarpa*, a similar form closely related to *O. bernardina*, the low, flat-jointed *O. occidentalis* (?), the tall *O. chlorotica*, low clusters of *Echinocereus engelmannii*, and a single species of *Mamillaria*.

Down the long grade to Mountain Springs the cacti and *Nolina* continued to be the most conspicuous elements of the vegetation, together with the white-leaved *Encelia farinosa* (incienso), *Simmondsia californica*, *Hyptis emoryi*, and the green-stemmed almost leafless *Thamnosma montanum*. In the narrow cañon below Mountain Springs we saw the first plants of *Fouquieria splendens* (ocotillo, or candle-tree), a bizarre desert plant which is often supposed to be a cactus merely because it is spiny. In the sandy bed of the cañon we now saw *Chilopsis saligna* (desert willow), *Hymenoclea monogyra*,—a fine-leaved composite,— and *Dalea spinosa* (smoke-tree), the most beautiful tree of the Colorado desert. On emerging from the cañon onto the great fan of sandy alluvium which stretches down to the Imperial Valley, we found ourselves in an extremely open stand of *Covillea* and *Fouquieria*, with a poor display of cacti and an extremely scanty number of herbaceous plants,—a few individuals of *Eriogonum* and the gray and prostrate *Psathyrotes annua* being the only frequent ones.

We returned from the desert to our camping site, and on the following morning had a short time in which to enjoy that locality again. The return to San Diego was made by a different route, through Buckman Springs, Descanso and Alpine. This detour brought us to the edge of the pine forest, where *Pinus ponderosa* (yellow pine) and *P. jeffreyi* were seen growing together, accompanied by a very open stand of the chaparral shrubs. In this immediate region it is very difficult to distinguish the yellow and Jeffrey pines, which appear to be much more distinct in the northern and central part of California. The one forester of our party gave an interesting demonstration of his ability to differentiate these pines by their manner of branching and by a difference in the odor of their leaves, apparently due to the presence of a charactristic oleoresin in each of the species. Between Buckman Springs and Descanso we were treated to the sight of virgin mountain parks, gray with a uniform stand of sage-brush and surrounded by pines. This

type of landscape,—so common north and northeast of here,—is of interest because it brings into juxtaposition the commonest tree of the southwestern forests and the commonest plant of the Great Basin. As seen here in the Cuyamaca Mountains this combination is doubtless near its southernmost limit. Nearer Descanso some hills were seen which bore a heavy stand of *Adenostoma*, apparently unbroken by the occurrence of other shrubs. Throughout the return journey we saw heavier chaparral on the hills, larger oaks in the valleys, and fewer of all the xerophytic shrubs. *Yucca* was absent, and not a single plant of *Opuntia littoralis* was seen, although we had observed it up to 2000 feet on the outward trip. These facts, together with the presence of pines, indicate a substantial difference in the physical conditions of the regions traversed by the two highways. North of Descanso lies Cuyamaca Peak, about 2000 feet higher than the pass east of Campo, a circumstance which probably brings a heavier rainfall to the former locality, and explains the observed differences of vegetation.

The opportunity which was afforded us for comparing the coastal and desert slopes of the Cuyamaca Mountains emphasized the difficulty of interpreting the distributional phenomena of this region in terms of "life-zones" so extensively used by faunistic and floristic workers. Two almost wholly dissimilar assemblages of plant and animal life occupy the eastern and western slopes of these mountains, and the entire complex of physical conditions is very unlike on the two slopes.

In Southern California, as an example, the delimitation of the Lower Sonoran zone, proceeding from a basis of temperature conditions, requires the embracing of at least three very distinct floristic areas: the coastal lowlands, the Mohave desert, and the Colorado desert—with the Imperial and Coachella valleys. The fact that these areas possess dissimilar floras is not of so much importance in this connection as the fact that their plants exhibit a striking dissimilarity of habit, structure and anatomy, by reason of their adjustment to the three unlike sets of environmental conditions. After we had witnessed the transition from the chaparral west of Campo to the junipers, cacti, nolinas and desert shrubs east of Jacumba, it was difficult to realize that we were in the Upper Sonoran zone on both occasions. When we reached the edge of the desert, with its extremely open stand of *Covillea* and *Fouquieria*, it was still more difficult to realize that we had re-entered the Lower Sonoran zone, which we had traversed for a short distance on leaving San Diego.

Such considerations emphasize the fact that we should not attempt to adjust distributional areas to conform to our knowledge of any of the controlling factors, for these inconsistencies have arisen from a supposed

similarity of temperature conditions in the localities which are placed in the same life zone. A natural and useful system of areas of plant and animal life should be based upon the characters of the organisms themselves—upon the total assemblage of those physiological and anatomical characters which bring the organisms into adjustment to their environment.

By Dr. F. B. Sumner

Scripps Institution for Biological Research.

A record of my impressions on the excursion across San Diego county would, I fear, have little more scientific value than the jottings of any tourist or sightseer. To a geologist or ecological botanist this trip must have furnished unlimited possibilities of observation and interpretation. For the landscape itself consisted of nothing but geology and botany—of mountains and cliffs, of forest, chaparral and desert. But where were the animals? Doubtless the ornithologist saw a bird of interest in every tree and shrub, but there was no ornithologist in our car. A herpetologist might have recognized the occasional lizards which scurried away over the rocks on our approach. Or an entomologist might have taken much satisfaction in noting the ants or beetles which were characteristic of the various sections of our route. But few zoologists would probably have added much to their knowledge of animal life.

However, I am not arguing that such a trip is profitless, even to a zoologist whose work does not lie in any one of the special fields mentioned. If he does not learn much regarding animals, he learns a great deal regarding the world in which they live. Considered as a succession of animal *environments*, this cross-section of Southern California is surely as instructive as it is spectacular. One does not need meteorological instruments to detect the change from the cool moist air of the coast to the warm, dry atmosphere of the plateau, and thence to the scorching winds of the desert. And even in this, the dry season of the year, one could judge pretty well by the vegetation of the comparative annual rainfall of the regions traversed. One who makes this trip for the first time is given a truly startling demonstration of the screening effect of the great mountain wall in determining the aridity of the interior valley. This picture, to be sure, is not so diagrammatically clear in the neighborhood of Mountain Springs as it is in the Laguna Mountains, a little further north.

Our car was unluckily separated from the rest of the party early in the trip, but we were so fortunate as to have some most congenial associates, including two botanists and a geologist.

By Dr. J. Grinnell.

California Museum of Vertebrate Zoology.

In traversing the southern road, from San Diego past Mountain Spring, the single feature of greatest interest to me pertained to topography. Having never been through that country before, my notions of it had been derived from brief references to it in literature, and I had imagined "the coast ranges" to consist of a series of narrow ridges parallel to one another and with intervening canyons. It was a surprise, therefore, for me to find that, instead, the elevated tract, extending from the top of the Potrero grade to the edge of the abrupt desert declivity above Mountain Spring, is a plateau. As pointed out by Mr. Stephens the surface of this plateau is rolling, reminding me of the peneplain country in parts of New England. The drainage is slow and the transition from the evident north-and-south line of greatest rainfall, in the vicinity of Campo, to the edge of the Colorado Desert, thirty or forty miles beyond, is gradual.

The effects of these topographic peculiarities upon the flora and fauna are such as to bring, not an abrupt change from Pacific coast conditions to those of the Colorado Desert, but a gradual blending, beginning near Campo and still in evidence at the edge of the plateau above Mountain Spring. It was with extreme interest that I noted the disappearance here and there of Pacific coast plants and the coming in of successively more xerophilous species. With very little doubt the behavior of the birds, mammals and reptiles accords in general with that of the plants, and I could only wish for the opportunity to hunt and trap throughout the entire section, and thereby determine the facts. The few species seen in our rapid transit did not happen to be of critical sorts.

Historically, the line of our trip passed several points of special interest to the student of systematic mammalogy, namely the type localities of a number of species. I was greatly interested in seeing the kind of ground where Mearns secured the specimens from which he described his several new forms: *Peromyscus crinitus stephensi*, *Perognatus fallax pallidus*, and *Lepus californicus deserticola*—in the vicinity of Mountain Spring and where the topotypes of *Peromyscus eremicus fraterculus*, *Peromyscus californicus insignis*, *Perodipus streatori simulans* and *Perognathus californicus femoralis* were obtained—on a brushy mountain side near Dulzura. Since the environment prescribes in large measure the characters of a species, one can never expect to

know it well, no matter how familiar he may be with specimens in a museum, until he has seen the locality of its native occurrence.

As for life-zones of the section, my brief and superficial survey, taking into account almost altogether the more conspicuous plants, indicates the following succession from west to east. (1) Upper Sonoran zone, in the immediate vicinity of San Diego (within the range of first effects of the sea breeze); (2) Lower Sonoran zone, dilute in degree, occupying a belt from a few miles out of San Diego to the vicinity of Jamul; (3) Upper Sonoran zone again, comprising the almost continuous chaparral belt from the last named point through to the vicinity of Jacumba; (4) Lower Sonoran zone, from the broad area of gradual blending marked centrally at the last named point and beginning purely at the edge of the declivity above Mountain Springs. A noteworthy feature, another surprise to one previously familiar only with topographic maps, was the total lack along the route traversed of the faintest representation of the Transition zone. The Mexican boundary of California cuts only the Austral life zones. There is no continuous highway for Boreal species south into the mountains of Lower California.

By Prof. George D. Louderback
University of California.

It is with considerable satisfaction that I recall the enjoyable and stimulating visit to San Diego last August, which included the very successful meetings of the Scientific Societies, the charming Exposition, the Scripps Institution at La Jolla, and the U. S. S. Albatross—two agencies of scientific research, and finally, sight-seeing trips through city and county. Among the varied activities of that time, I look back with particular satisfaction on the "cross-country" excursion, both as a pleasant and exhilarating outing with most congenial companions and a most instructive display of the general geographical and geological conditions of southernmost California.

The use of automobiles for transportation naturally broke the party into small groups, and the group of which I was a member encountered a series of minor mishaps and failures of cooperation on the part of the automobile-controlling elements of the local fauna. The chief resulting disadvantage was our separation from companionship and opportunities for discussion with the larger membership of the party. On the other hand, the smaller group was a very congenial one, and the delay made it possible for most of us to take a very profitable unscheduled side trip across the Mexican border near Campo.

For the amount of time involved, the route of the excursion was excellently chosen to present a general view of the major geological features of the extreme Southwest. The main structural features of the region show an approximately north-south elongation or trend, and the trip was essentially a transverse section of these features from coast to desert, showing their succession and spacial relations to the best advantage.

General Features.—In a general way the region traversed may be divided into three parts: the coastal, the mountain, and the desert belts, and these are separated by two border or transition zones. In many ways these three belts show contrasted conditions and geological activities. But a more general and fundamental view will unite the three into a greater diastrophic province. Their histories, although different in detail or in character, have been closely bound together. Their chief periods of disturbance, or quiet, their relative elevations and lines of separation have been primarily determined by a closely related group of movements that have also determined the formal relation of ocean to continent in that region and given rise to the group of structures that, extending hundreds of miles to the south, express themselves in

the peninsula of Lower California with its adjoining water bodies on both sides.

The central or mountain belt is the dominating one of this structural group and has exerted an important influence on each of the bordering belts. It is at the same time the barrier that separates them, determining their main differences, and the link that relates them to each other. A complete understanding of the mountain belt can only be gained by a study which includes both of its bordering belts, and it is for this very reason that the plan of the excursion was so well adapted to the geologically inclined visitor—better, for example, than a much longer excursion that might have ended in the midst of the mountain belt, without reaching the border on the desert side.

The Coastal Belt.—For some miles after leaving San Diego, the most striking geological feature is the broadly developed, gently sloping or practically flat terrace or "mesa" which extends up to the mountains. It represents a surface developed in earlier times when the coastal belt lay lower with respect to the sea level than it does at the present time.

This terrace is commonly underlain by gravel with a rust-colored matrix, the original deposit laid down by the agents that shaped the old plain. This deposit conforms with the terrace surface and therefore usually forms a horizontal or slightly inclined layer which in cliff or canyon sections is seen to contrast with the underlying sandstones, shales and other rocks of the older formations whose strata usually lie more markedly inclined to the horizontal, and sometimes dip at high angles. It is evident that these older rocks (Cretaceous and Tertiary, but whose time limits have, as far as I know, not been definitely ascertained) were disturbed by various earth movements—tilting, folding, faulting—before the terrace material was laid down, and the plain of which this terrace is the remnant was originally cut across the older strata by processes of abrasion.

The "mesa" is separated from the ocean, and in many places from the valleys, by a number of narrower terraces, with intervening steeper slopes or cliffs. Along the immediate coast there is definite evidence that these terraces are raised ocean beaches; farther back, they are of stream origin. Just how large or how small areas should be apportioned between marine and fluvial abrasion was not determined, but, to a hasty view, the major portion of the broad terrace covering appeared to be the result of stream deposition, and the valley extensions of the narrower terraces are evidently of river origin.

Comparatively recent successive elevations of the coast have caused the streams to work to successively lower base-levels and the old plains

have therefore been cut into and dissected. The present cycle of erosion has not been in operation long enough for small streams to do more than cut narrow valleys, while the larger streams have started on a career of lateral corrasion and have produced valleys, in some cases, a half mile wide or more.

The whole belt is characterized by the small amount of general erosion. Even the broader valleys show steep-walled sides and one passes with great abruptness from the flat terrace floors of the divides into the trench-like valleys. Furthermore, the original terrace covering has been retained over wide areas where not actually cut out by the streams in excavating their valleys. The factors determining these phenomena are probably the original plane surface of the country into which the valleys were cut, the recency of the uplift, and especially the low precipitation and low humidity of the atmosphere.

The lower terraces apparently never occupied a large portion of the coastal belt, and at the time of their formation and maximum development were more in the nature of coastal fringes or comparatively narrow valley flood plains. But as we left San Diego, we rose onto the high terrace or dissected plateau. This gave us a broad and beautiful panorama and it would seem that at the time of its formation and maximum extent it must have occupied the whole width of the coastal belt, and probably extended farther out to sea than the present shore. At that time the country must have had the aspect of a practically unbroken low coastal plain extending from the mountains to the sea, and for many miles both to the north and south of the position of San Diego. The streams must have flowed in very shallow troughs. If those conditions had been maintained to the present, the wonderful views over the bay and along the coast that can be obtained from the Exposition grounds and from other elevated parts of San Diego would not now be available, but the railroad would have no grade to contend with such as it encounters climbing out of Soledad valley.

The Transition Zone.—As the road approaches the mountains, it enters a valley, and the relation of the coastal terraces to the range front was not well seen, but the transition appears to be abrupt. The hills rise rapidly from the level of the highest terrace, and the terrace in places extends back of the line of steep-fronted mountain salients and appears to pass into lateral valley terraces up the main streams. It is soon evident that we have passed into a region of crystalline rocks. Whether the mountain front is essentially an old development affected by later erosion and other modifying influences, possibly antedating the Tertiary or even older sediments of the coastal belt, or whether it is of more recent origin; whether it is essentially of erosive origin or was

initiated by earth movements (tectonic) is a matter worthy of careful investigation. Its general appearance would seem to indicate a structural origin in comparatively recent time, with considerable modification by erosion.

The Mountain Belt.—Within the mountain belt the road winds about along the valleys and across low divides, giving here and there glimpses or longer views of certain prominent mountains, such as San Miguel, Jamul and San Isidro, which according to the work of Fairbanks are composed of igneous types of rocks (porphyries), more resistant to erosion than the granites or the later sediments.

Wherever the rocks were exposed along our road, or where, in particular, an opportunity was given to get out and examine them more closely, they were of granite (in the general field sense) or related or genetically associated types. This held, with but few minor exceptions, along our whole course across the mountain belt and into the desert. We may look upon the mountain belt that lies between the San Diego Coast and the Imperial Valley as essentially a great granite mass, showing at its surface only subordinate exposures of rocks of unrelated types.

It has apparently been definitely established that granitic rocks of this character are products of fusion and are necessarily formed under a thick mantle of rock. If we picture the conditions at the time of the consolidation of the granites, we must imagine their upper surface to have been far below the earth's surface, and to have been succeeded upwards by a thickness of metamorphosed rock—probably several thousand feet—and finally, perhaps, by rocks, extending to the earth's surface, whose composition and texture were unaffected by the heat or material emanations of the granitic magma or by the agencies which had developed the molten mass. The evidence suggests that this granitic mass underlay a mountain area at that time, though its form and extent were probably not the same as the mountain belt of the present time. The excursion gave a good opportunity to observe how completely the original covering of the granite has been eroded, not simply along certain lines of deep stream cutting but over broad areas. In fact the original "roof" appears to have been wholly removed and with it a certain thickness of the granite itself.

This gives evidence of a very long period of erosion, one not simply long enough to cut a system of canyons or valleys thousands of feet deep, but one long enough to cut away the divides and remove in toto from some thousands of square miles, thousands of feet of the outer crust. And this necessarily long period of erosion means that the territory involved was an exposed land mass during much or all of the

period, or, otherwise stated, that it was not a depressed area receiving marine or other types of sediment.

As to the age of the formation of the granite, the excursion only gave indications that it was earlier than the observed Tertiary, but other evidence would suggest that it is at least pre-Cretaceous. As to how much earlier than the Cretaceous the granite was formed has not, as far as I know at present, been definitely determined. Certain rocks intruded by the granite farther north yielded fossils that have been referred to the Triassic. The intrusion may be as late as the late Jurassic, and thus correspond to extensive granite intrusions that are found in the Sierra Nevada.

At intervals the road climbed to more prominent divides in passing from one creek valley to another, and a broader extent of country could be seen. To the east of Campo and before the descent into the Imperial valley the country is especially open and affords good general views of the Summit region. A moderate climb to a hill not far from the road broadens the horizon still more.

The topography of the summit region proved to be of considerable interest. There is no sierra, no prominent or striking peaks rising high above their surroundings, no wild or rugged mountain scenery. The relief is quite moderate, and in distant views the hills appear to unite to give a remarkably even summit surface or plateau effect, below which lie the commonly shallow and open mountain valleys, and into which an occasional canyon is incised along the border of the summit region.

The small section of the party that was fated to stay at Warren's ranch over night, climbed up a small granite knob in the early evening. Our eyes were alternately drawn to the western horizon by the beautiful sunset, and towards the eastern horizon by the rising full moon. It was the 13th of the month, and our automobile had broken down and disconnected us from the main party, but I am sure that any misgivings that we may have had were thoroughly dispelled and replaced by a feeling of pleasure that such a remarkable scene on such a wonderful night had been made available to us. The general plateau effect was strikingly brought out, and it was this very feature of the summit region that made possible the simultaneous presentation to our view of sunset and full moon.

The dominant character of the summit region, I believe to be the result of the long period of erosion above mentioned which removed the covering from the granitic rocks. The indications are that this region was thereby reduced to a very moderate or low relief, that, in terms of geographic cycle, the topography became at least that of advanced maturity, possibly of general peneplaination. It seems probable that this

cycle occupied at least all of the Cretaceous and possibly the early Tertiary, though its limits are yet to be determined.

During the time of the production of this old surface the region of the present mountain belt must have had a much lower position with respect to sea level than it has at present. For marine sediments formed from its waste are found near San Diego, and such a topography could not be formed at a high elevation so near a base-level of efficient erosion.

The subsequent uplift of the region to its present altitude was not a continuous process. There is evidence within the mountain belt and along its edges, that it took place during several successive periods with longer or shorter periods of quiet between. Early in this history of uplift a beginning was made in the dissection and destruction of the old surface form and later movements have only tended to accelerate the destructive process. Under recent conditions of elevation and base level the streams are cutting deep canyons along the border of the mountain belt and these are extending their influence back towards or into the summit region. With the long history of attack, it is remarkable how the influence of the older surface persists in the present topography.

The Eastern Transition Zone.—At the east edge of the mountain belt, the most striking feature is the steep descent to the broad Imperial valley. From a large area of rather mild topography, we have an abrupt transition into high, precipitous and rugged slopes which in a short distance lower the surface several thousand feet, and then again an abrupt passage into the low relief—to a large extent an almost featureless floor—of the valley of the Salton Sea. The view from the upper edge of the mountains is very extensive and is most impressive. The contrasts are marked.

The mountain front is notched by canyons, and these are being extended back into the summit region. The progress of their attack and the stage of their development are among the more interesting geological features of the eastern part of the mountain belt. They are far less developed than the canyons of the western part, and have done much less damage to the earlier erosion forms. Without more definite data this might be supposed as possibly in part due to a later development of the eastern than of the western mountain slope, or to an initial west slope of the plateau surface, or a western tilt developed during uplift, that would determine longer and more effective drainage lines towards the west. It is probably dependent in part on the difference in rainfall on the east and west slopes.

It is clear that the present relations of the mountain belt and the Imperial valley, likewise of the mountain and the coastal belts could

not have obtained during the development of the advanced mature or peneplain surface of the summit region. If that were in process of formation during the Cretaceous and early Tertiary, then the present relations must have been established by differential movement of the mountain belt with respect to the desert and coastal belts since that time. The sequence of major movements and resulting conditions and activities have not been definitely determined. The evidence at hand, however, would seem to indicate that the latest movements, which resulted in physiographic relations of the elevated and depressed belts, essentially as at present, took place in rather late geological times—not earlier than late Tertiary, possibly even in early Quaternary. To its comparative recency of development, and to the arid climate are due the steepness and ruggedness of the mountain front that must be descended to reach the Imperial valley.

The Desert Belt.—We ran but a short distance out on to the valley floor, but far enough to see some of the important features of its western edge. The streams, for all their shortness of water, bring much detritus down into the valley, including very coarse material which is mostly deposited not far from the edge of the mountains. One might have expected that all the older formations of the valley would be buried from sight by the more recent detritus. But evidently the western edge of the valley itself is now in process of dissection and erosion, and shows exposures of older formations in the sides of the present stream trenches. And it is not only the streams which have their sources in the mountains that have cut such trenches. There are many small branching gulches formed by the temporary streams that result from the occasional desert rains. They work back into the old valley floor by headwater erosion from the trenches of the mountain-born creeks.

So by the side of the road we found exposed stratified sediments—shales, sandstones, etcetera—tilted up at a considerable angle. They could be traced up to and into a high ridge that extends into the desert to the north of the road (Carrizo Mountain). These rocks have been referred to the upper Miocene by Arnold. They evidently had been formed and then disturbed, tilted, folded, and faulted before the present general relations of mountain and desert were established.

Kew has pointed out that the fossils found in these beds are strikingly different in species and character of development from those found in beds of presumably the same age found in the coastal province. Only 8.5 per cent of the species are common to the two regions. The differences are of the same general nature as now found between the fauna of the shores of the Pacific Ocean and of the Gulf of California and indicate that at that time, as at present, the mountain belt existed as a

divide between the depositional basins to its west and east, and also, as at present, warmer waters existed in the eastern basin than in the western.

In the vicinity of the road, these tilted Tertiary sediments have been truncated by stream action. A fairly plane surface was cut across their edges, and on this have been deposited water-laid sands and gravels over a broad area. They here form the old valley floor which the present streams are dissecting. They are probably Quaternary in age.

These gravels which often carry rather large boulders, are made up of a variety of rock types evidently derived from the mountains. Of particular interest is the large quantity of volcanic pebbles of various types, for on the road down the mountains one may not notice volcanic rocks either in the canyon walls or in the creek detritus. But volcanic rocks do occur along the mountain front to the north and south, and near the eastern edge of the high mountain area, hills were observed with flat-lying rocks that seemed in part at least to be volcanic. These volcanic rocks, both along the range front and on the summit region, must have been much more widely spread before the erosion period that produced the gravels of the valley, and streams that were formerly flowing in lava beds have removed the volcanic covering from the surface and are now cutting into granite.

On the surface of these desert gravel beds lie many scattered pebbles and boulders that show beautifully the effect of desert polish, etching, and sometimes of the development of a surface film, although the typical desert "varnish" was not observed.

Weathering and Erosion.—In the journey across the mountains the weathering forms of the rocks, especially the granitic rocks, were constantly before us, and occasionally we had the opportunity of observing the effects more closely in road cuts or stream banks. They were typical of arid conditions. Jointage, spalling, mechanical disintegration are the controlling features. Decomposition, soil formation are relatively slight.

Rock exposures are numerous on the hillsides and even the flatter elevated slopes. Samples of the rocks taken from these surface exposures commonly show the minerals to be lustrous and but little altered in composition, but the rock may crumble in the fingers or be easily broken up with a hammer.

Here and there a surface is seen covered with large rounded rock masses, often averaging several feet or even yards in diameter, and the impression may be given of glacial erratics scattered over the surface. But a closer examination shows these to be boulders of disintegration formed in place, though sometimes slipped, rolled, or washed to a lower

position. They were nuclei in a process of spheroidal weathering, and the intervening rock material has been split off, disintegrated and carried away by wind or rain and thus these rounded blocks were left lying upon the surface. Their stages of development are sometimes well exposed in road or stream cuts. Their relation to the floor on which they rest is often shown by a vein or dike that cuts through the boulder and is continued in the bedrock at its base.

In the summit region, dome forms are often produced, the form of the hills being determined by the curving joint planes in the granite rock.

Even where the relief is moderate or low, a surprising number of bare rock surfaces are exposed. The products of disintegration must be washed, blown or slid away before plants can get a hold that might tie the slowly developing soil to the rock beneath.

Most striking were the results of the heavy storms that affected the whole region last spring. The streams had made fresh and often deep cuts, and had exposed and moved great quantities of large rocks which normally they would but flow around. Landslide scars on the hillsides were common sights, and on the higher and steeper slopes, the similar bare strips cleared of their slight coating of vegetation (lichen and brush) by the rush of the rain waters gathered into steep and narrow runways.

In the low grade stream valleys of the summit region the detritus gathers from the mountain slopes and frequently carries considerable water—often more water under ground than in the stream bed.

The biologists may be interested to note that in the struggle for existence under unfavorable arid conditions many of the streams become adapted to their environment, by developing a bed of gravel and sand through which the water may flow with a minimum effect of evaporation. The surface stream bed may to all appearances be dry and lifeless while beneath the protective covering a goodly amount of water may be moving onward towards the sea. Naturally those streams which have the better adapted themselves, have a better chance of surviving through the dry season.

Decomposition and the formation of soil is more marked in these valley bottoms. They are the favorable seats for trees and many fine large ones were observed in such situations. But on the hillsides that usually have little or no soil covering, and slight water conservation plants have a more precarious existence.

A cross country excursion is valuable in giving one a picture of a region's general features, geographic, geologic and biologic, in their

natural setting, and in exhibiting their mutual relationships. It fits one the better to understand the reports of investigations of special aspects or particular features of the territory observed. But its value is greatly enhanced if it leads to the recognition of problems for future research. And this particular excursion impressed me as especially valuable in that regard.

The territory which we had under observation has been rather neglected by geological investigators. Excellent work has been done, but only in comparatively small amount. There has been an impression that the problems were not especially inviting, that the features were of comparatively few types and somewhat monotonous. But in reality it appears to be rich in problems of most interesting types.

The physiographic history—the history of the development of the present geography—offers a most excellent field for investigation. The comparative uniformity of rock material over large areas has to a large extent freed the action of erosive agencies from the complications of the differential resistance of a multiplicity of rock types. The methods would necessarily be largely physiographic but not exclusively so. The remnants of Tertiary lavas and sediments resting on the old erosion surface of the mountain belt are apparently few in number, but offer possibilities for the discovery of evidence of important events in the history of the region, for correlating the events of the highlands with those of the lowlands, and the more accurate dating of the movements that raised the mountains above the coastal and desert belts.

Ridges rising above the general summit level with suggestive outlines seem to indicate internal movements in the mountain block that call for elucidation.

Peculiar drainage features such as are presented by the valleys about Tecate Mountain, point to events that illustrate general conditions in the physiographic history. And peculiar stream valley alignments, such as the long and straight armed cross formed by Pine, Lyons and Cottonwood creek valleys, call attention to structural features that are not otherwise apparent on a rapid trip through the field.

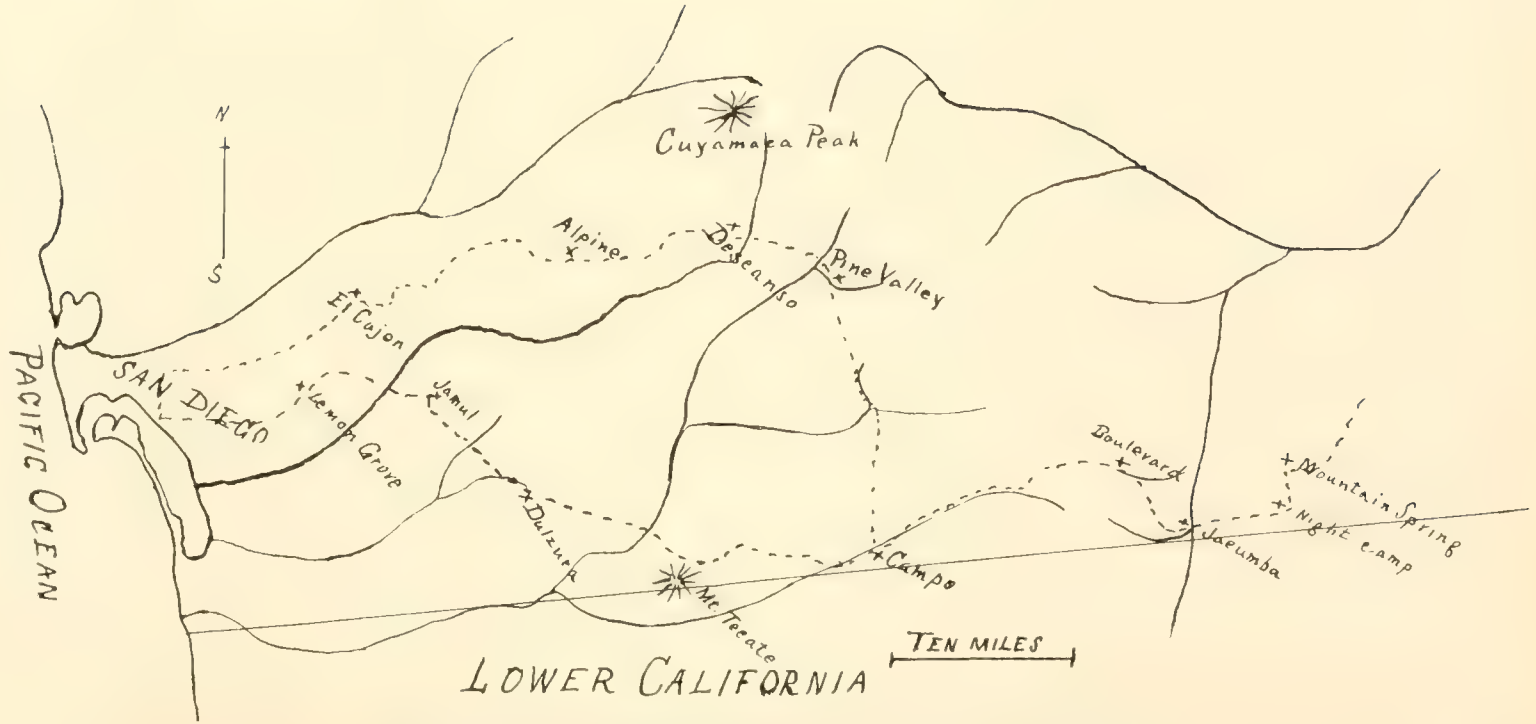
The nature of the transition zones between mountain belt and the lowland belts is still imperfectly understood. The structure, stratigraphy, and physiographic history of the lowland belts are only known in a general way.

Careful studies of the sediments in the east and west basins would undoubtedly yield facts important for the history of the basins, and also contribute to an understanding of the character and history of the adjoining mountain belt.

The history of the relations between the coastal belt and the ocean includes a field of many unsolved problems. The processes that have determined the shore line and the present configuration of the immediate coast, the origin of the submarine and off-shore features of the land and the sequence of the movements and changes that have produced them, these most interesting subjects have not as yet been carefully studied and the numerous questions to which their consideration gives rise can only be answered now in terms of possibilities.

Lastly may be mentioned the excellent field that exists for the study of forms and products of arid erosion and weathering—a study that has excited considerable interest in recent years, but yet one in which much remains to be done. All three belts would yield material for this study.

I can only hope that with the encouragement and cooperation of the San Diego Society of Natural History, and inspired by the zeal for research displayed by the small but earnest group of workers at the Scripps Institution for Biological Research, a number of serious students may become interested in the rich, and but slightly cultivated, field for geological investigation offered by the land and sea surroundings of San Diego.



SKETCH MAP OF THE REGION TRAVERSED BY THE EXCURSION.

The dotted line indicates the route followed.

OPEN STAND OF CHAPPARAL
Altitude about 1000 feet

CLOSED STAND OF CHAPPARAL.
near Dulzura.

TECATE CYPRESS

THE CAMP GROUND

BARREL CACTUS. "BISNAGA."
Echinocactus cylindraceus.

THE DESERT WILLOW.
Chilopsis linearis.

PINE VALLEY

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Palaeozoic Crustacea

The publications and notes on the genera and species during the past twenty years, 1895-1917

BY

ANTHONY WAYNE VOGDES

TRANSACTIONS SAN DIEGO SOCIETY ON NATURAL HISTORY

VOL. III, No. 1. July 20, 1917

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The object of this fasiculus is to give all the literature on the Palaeozoic Crustacea, also a general index to its contents, with a list of the species and remarks on them. This will aid the student in his researches and save time in looking up the descriptions of the species and genera.

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INTRODUCTION

In offering this supplement to the literature of the Palæozoic Crustacea, the author has brought the list up to date, and corrected some errors and omissions in his Bibliography, previously published by the California Academy of Sciences.

The author has consulted the original papers and the bibliographies of the following authors:

1 **Gehler** (J. C.) De quibusdam rarioribus agri Lipsiensis petrifactis.
Spec. 1, Trilobites Entomolithus pararadoxus Linne, Lipsiae, 1793, pp. 7-9.
The author gives a list of works on fossil crustacea.

2 **Walch** (J. E. T.) Des Trilobites dan le regne des petrifications, etc.
Natural History of Petrifactions to illustrate Knorr's Collection.
Nuremb. fol., part 2, pp. 95 (1768) and part 3, p. 120 (1771).
The author gives the name of Trilobites to the class and brought together everything that had been hitherto written on the Trilobites.

3 **Brunnich** (M. T.) Beskrivelse over Trilobiten.
Nye Samlig. of det Kongelige Danske Videnskabers Selskabs Skriften, Kiöbenhavn, 1781, pp. 384-389.
Gives historical sketch of the papers on Trilobites.

4 **Burmeister** (Hermann). The Organization of Trilobites.
German Edition, 1843; English Edition, 1846.
The author gives a Bibliography, pp. VII-X, 1698-1845.

5 **Barrande** (J.) System Silurien du centre de la Bohéme, 1852, Trilobites.
Vol. 1, and supplement.
Gives Bibliography of the families.

6 **Törnquist** (S. L.) Undersogningar öfver Siljansomradets Trilobitfauna.
1884, Sveriges Geol. Undersökning, ser. C, No. 66, pp. 4-7.
Gives list of authors.

7 **Schmidt** (Fr.) Revision of the Baltic Silurian Trilobites.
Mem. Acad. Imp. Sci., St. Petersburg, 1881-1907.
Notes on the genera and bibliography.

8 **Holm** (G.) De Svenska Arterna af Trilobitslaget Illaenus.
Bihang till K. Svenska Vet. Akad Handl. Bd. 7, No. 3, 1882.
Gives the Literature on the genus Illaenus, 1853-1872, pp. V-XIV.

9 **Vogdes** (A. W.) A Bibliography of Palaeozoic Crustacea from 1698 to 1889, including a list of North American species and a systematic arrangement of the genera.
Bull. U. S. Geol. Sur., No. 63, 1890.
This paper gives a list of authors; also that of the genera, but not that of the species described in each work.
The 2d and 3d parts a Catalogue of North American species.

10 **Vogdes** (A. W.) A classed and annotated Bibliography of the Palaeozoic Crustacea, 1798-1882, to which is added a Catalogue of North American species.

California Acad. Sciences Occasional Papers, No. 4, 1893.

This work contains a list of the genera and species described in each paper and a catalogue of North American species.

11 **Vogdes** (A. W.) A supplement to the Bibliography of the Palaeozoic Crustacea.

Proc. Cal. Aca. Sci., 2d ser., vol. V, 1895, pp. 53-76.

12 **Taschenberg** (O.) Bibliograeca Zoologica II. verzeichniss der schriften ueber Zoologie welche in den Periodischen werken, 1861-1880, pp. 5165-5188, Leipzig, 1905.

13 **Calman** (W. T.) Zoological Record Crustacea X, vol. 39-47, 1902-1913.

A Classified and Annotated Bibliography of the Palaeozoic Crustacea, Part 2; Supplement to Occasional Papers California Academy of Science, Embracing the Publications for the Years 1895 to 1917.

Airaghi (Carlo). Di alcuni Trilobiti della cina.

Atti Mus. Milano, vol. 41, 1902, pp. 3-13, plate.

The author describes *Agnostus Pii* n. sp. compares *Agnotus acadicus* Hartt and other species, the new species very much like *Agnotus Chinenis*, Dames, 1883.

Olenoides Paronai n. sp., *O. Leblanci* Berg. *Microdiscus Paronai* n. sp.

Drepanura premesnili, Berg. Trilobites gen. sp. ind.

Part 2 describes a Trilobite from Scitan tung, Teingan, as *Cheirurus Paronai* n. sp.

Ami (Henry). *Belinurus grandaevus*, a new species of Palæozoic limuloid Crustacean recently described by Prof. T. Rupert Jones and Dr. Henry Woodward, from the Eo-Carboniferous of Riversdale, Nova Scotia.

Ottawa Nat., vol. 13, 1899, pp. 207-208.

See also Geol. Mag., Decade 4, vol. 6, 1899, pp. 388-395, pl. 15.

The genus Belinurus has been found in Lower Devonian and Silurian forms in the Kiltorcan beds of Ireland.

See Review of this paper, Geol. Mag., Decade 4, vol. 7, p. 177, 1900.

Andrée (Karl). Zur Kenntniss der Crustaceen Gattung Arthropleura Jordan, und dern systematischer Stellung.

Palæontographica Bd. 57, Stuttgart, 1910, pp. 67-103, plates 4-5. *Arthropleura armata*, Jordan, *A. mammata*, Salter.

Gives a Bibliography of the literature on *Arthropleura*, 1854, 1909.

——— Neue Funde von *Arthropleura armata* Jordan.

Centralbl. für Mineral, 1909, pp. 753-755.

Arber (E. A. Newell). The Culm Measures of the Exeter District.

Geol. Mag. Decade 5, vol. 8, 1911, p. 495.

The Arthropod remains from Nottinghamshire and Derbyshire coal fields in this paper are described and illustrated by Lewis Moysey.

Leaia trigonoides sp. nov. Glabella region of Prestwichia figured.

Baldwin (Walter). Belinurus Konig from Sparth, Rochdale.

Trans. Manchester Geol. and Mining Soc., vol. 28, pt. 6, 1905, pp. 198-202.

The author remarks Belinurus is generally associated with Unio-like shells and scattered plant remains, and suggests that it was an inhabitant of shallow, muddy water and lived in close proximity to the shore line. He also gives a Bibliography of the genus.

Belinurus forms were first discovered in the Pennystone iron nodules of the Coal Measures at Dudley in Staffordshire and Coalbrook Dale, in Shropshire.

Martin, the first author to describe a species in 1809 (Petrifacata Derbiensia, pl. 45, fig. 4), classes it among the Trilobites as *Entomolithus lunatus*.

Charles Koenig, who was the first keeper of the Mineralogical and Geological Department in the British Museum in the year 1825.

Published under the title of Icones Fossilium sectiles, n. d. (1820) in two parts:

The First Centuria has only 8 plates and 100 figures accompanied by descriptions.

The Second Centuria, consisting of plates 9-18, figures 101-248, was issued without text descriptions.

Koenig gives the name of *Belinurus bellulus* to fig. 230, without a description of the new genus.

——— *Prestwichia anthrax and Belinurus lunatus* from Sparth Bottoms, Rochdale.

Trans. Manchester Geol. Soc. vol. 29, 1904-1905, pp. 124-127, with 2 figures.

The author figures *Prestwichia anthrax* described under the name of *Limulus anthrax* by Prestwich in 1840, and refers to *Belinurus lunatus* Konig's *Belinurus bellulus*.

The author remarks, that it certainly is not a fossil insect, as indicated by Martin in Petrifacata Derbiensia, pl. 45, fig. 4, 1809.

Bather (F. A.) *Harpes bucco*. A new Silurian Trilobite from the Carnic Alps.

Catania Rivista Italiana di Palæont., 1910, 7 pp., figure.

The trivial name bucco alludes to the swollen cheek roll, which with its ornament is so marked a character to the species.

Barth (Hermann von). Die Stellung der Trilobiten in Zoologischen Systeme.

Das Ausland 26 Jahrg, 1875, p. 25.

The author quotes Billings's paper; also that of Dana on the feet of Trilobites, and refers to the discoveries of E. von Eichwald in Wesenberg in Estland, and in the Island Dago near Hohenholm.

N. Jahrb für Mineral. and Geol. vol. 1, 1875.

Barton (Donald C.) A new genus of the Cheiruridae with descriptions of some new species.

Bull. Mus. Comp. Zoology, vol. LIV, No. 21, 1913, with one plate.

The new genus Ceraurinus is like *Cheirurus insignis* Beyrich in size.

The glabella is subrectangular or expanded only slightly. The posterior of the 3 pairs of glabellar furrows are straight, about one-third the width of the glabella in length, and slope gently backwards.

Their inner ends are connected with the neck furrows by curving constrictions, which are about parallel to the axis of the glabella.

The constrictions are strong in some species and flat in others.

The middle part of the axial portion of the neck furrow is parallel to the posterior edge of the neck segment.

The eyes large.

Thorax 11 segments, presumably.

Pygidium only in *C. icarus* Billings, three to four segments ending in six free spines of equal length.

Type *Ceraurinus marginatus* sp. nov.

The author includes in the genus *C. icarus* Billings, *C. trentonensis*, sp. nov., *Crytometopus scofieldi* Clarke, *Cheirurus polydorus* Billings, and *C. pompilius* Billings.

He refers *Ceraurus meekanus* Miller, 1889, to *C. icarus* Billings.

The paper ends with a fragment, described as *Ceraurinus confluens*, n. sp.

——— A revision of the Cheiruninae with notes on their evolution.

Washington Univ. Studies, vol. 3, part 1, No. 1, 1915.

BARTON (Donald C.)—Continued

The author places under the family cheirurinae twenty genera divided into two sections.

Group 1. Cheirurinae with plural furrow horizontal, thoracic segment rarely 9, generally with 10 or 12.

Under this group he places:

Eccoptochile Corda, genotype *E. claviger* Beyr., with figure.

Actinopeltis Corda genotype *A. globosus* Barr, with figure.

Cyrtometopus Angelin genotype *C. clavifrons* Dal., with figure.

Sphaerexochus Beyrich genotype *S. mirus* Beyr., with figure.

Anacheirurus Reed genotype *A. Frederici* Salt., with figure.

Pilekia new genus genotype *Ch. apollo* Bill., with figure in text.

This is an early Ordovician genus unlike the Cheirurinae. The author figures the glabella, which contracts forwards with three pair of glabellar furrows; pygidium composed of 4 complete segments and a terminal axial plate, the ribs terminating in long spines. He refers *Ch. gracilis* Barr. Cyr. *foveolatus Ang.* and with doubt *Ceraurus Clintoni* Foerste to the genus.

Nieszkowskia Schm. genotype *N. cephaloceras* Nieszk., with figure.

Kawina new genus genotype *Ch. vulcans* Bill., fig. of head in text.

The glabella large and composing one-half of the head strongly swollen, and with a tendency for a faint hump at the posterior. Three pairs of glabellar furrows, facial suture running almost parallel to the sides of the glabella, and cutting the border at the genal angles or slightly in towards the axis. Genal angles without spines.

The author refers to this genus *Ch. prolificus* Bill., *Ch. mercurius* Bill., *Pseudosphaer. Billingsi* Raym. and *Pseudo-sphaer. approximus* Raym.

Pseudosphaerexochus Schm. genotype *P. hemicranium* Kut., with figure, includes 11 species. *Cheirurus Paronai* Airaghi probably belong here, but the author does not include it.

Placoparia Corda genotype *P. Zippei* Boeck, with figure.

The author includes also *Calymmene tourneminei* Rouault, but does not mention *P. cambriensis* Hicks.

Area Barr. genotype *A. bohemica* Barr., fig. in text.

The author includes *A. Fritschi* Barr., but no mention of *A. suecica* Olin.

Prosopiscus Salter genotype *P. mimus* Salt., with figure.

Typhloniscus Salter genotype *T. Bainii*, figure in text.

Sphaerocoryphe Angelin genotype *S. dentata* Ang.

This is a Swedish species, the figure 16 in the text after Schmidt, looks more like *S. cranium* Schm. pl. 8, fig. 7.

Hemisphaerocoryphe Reed genotype *H. pseudo-hemicranium* Nieszk., with figure.

This is an intermediate genus between Cyrtometopus and Sphaerocoryphe. From Cyrtometopus this genus can be distinguished by its highly inflated frontal lobe. From Sphaerocoryphe it may be distinguished by its obtusely triangular free cheeks and by its posterior pair of glabellar furrows, which bend sharply backward instead of extending across the glabella.

The author includes besides the type *Metopias aries* Eichw. and Cyrt., *Rosentali* Schmidt.

Group 2. Cheirurinae with constricted pleurae and with diagonal pleural furrows, Lehua nov. genotype *Ch. vinculum* Barr.

The genus resembles Eccoptochile and Anacheirurus. From the former it is most readily distinguished by its lack of eyes or, if present, situated far forward, and by the diagonal pleural furrow, and by the slender spine-like termination of the pleurae.

The author includes besides the type *Typhloniscus princeps* Reed and *Ch. inexpectatus* Barr.

BARTON (Donald C.)—Continued

Cheirurus Beyrich genotype *Ch. insignis* Beyr., with figure.

The genus can be readily distinguished from Ceraurus and Ceraurinus by the triangular basal lobes of the glabella, the inner points of which are not separated by a portion of the glabella; also by the hypostoma.

Crotalocephalus Salter, genotype *C. Sternbergi* Boeck. Fig. of head in text.

Ceraurinus Barton, genotype *C. marginatus.* Fig. in text.

Distinguished from Cheirurus and Ceraurus by the rather large ovate to subrectangular basal glabellar lobes.

Ceraurus Green, genotype *C. pleurexanthenus.* Fig. in text.

The author does not include Youngia, a genus described by Lindstrom, with *Cheirurus trispinous* for its type, in 1885—not Youngia, Jones & Kirby, 1886.

The genus has long genal spines with aculate occipital ring, and may be compared with Nieskkowskia.

Lindstrom genus has a peculiar axis to the thorax, the first axial joint being furnished with a pair of small lateral processes on the anterior margin.

Barbour (E. H.) Carboniferous Eurypterids of Nebraska.

Am. Jour. Sci., 4th ser., vol. 38, 1914, p. 507, figs. 1 and 2.

The author describes *Eurypterus (Anthraconectes) nebraskensis* nov., from the Coal Measures near Peru, Nebraska.

The main features are the vermiform appearance, the long spatulate paddles, and the spinous ridges upon the last 5 tergites of the post abdomen.

Fig. 2 represents an unnamed sp.

Basser (Ray S.) Bibliographic index of American Ordovician and Silurian Fossils.

U. S. Natl. Mus. Smithsonian Inst. Bull. 92, volumes 1 and 2, 1915.

The author gives a historical index to the genera and the North American species of Palæozoic crustacea during Ordovician and Silurian epochs.

Beecher (Charles E.) Notes on Cambrian fossils of St. Francis County, Missouri.

Am. Jour. Sci., ser. 4, vol. 12, 1891, pp. 362-363.

——— On the thoracic legs of Triarthrus.

Am. Jour. Sci., ser. 3, vol. 46, 1893, pp. 469-470.

— The larval stages of Trilobites.

Am. Geol., vol. 16, 1895, pp. 166-197, plates 8-10.

The author gives a review of larval stages of Trilobites.

Analysis of variations in Trilobite larvae.

Antiquity of the Trilobite.

Restoration of the protaspis, etc.

The author remarks in regard to the larval stages of the following Trilobites from the Cambrian:

Solenopleura robbi Hartt., after Matthew.

Larva very minute and circular in outline; the glabella is obscurely annulated and extends to the anterior margin, where it is expanded.

The neck ring is only one, well defined; abdominal portion is less than one-third the whole length, and is limited by a slight transverse furrow; no traces of eyes or free cheeks.

Liostracus onangondianus Hartt., after Matthew.

BEECHER (Charles E.)—Continued

This form is similar to the preceding though larger, and with the glabella more rapidly expanding in front. The neck segment is the only one which is distinct.

Ptychoparia linnarssoni Walcott, after Matthew.

The axis is narrow, expanding in front, and obscurely ringed; 5 annulations belonging to the head and one to the pygidium, which is very short and separated from the cephalon by a distinct groove.

Ptychoparia kingi Meek.

The author remarks that fig. 6 which is referred to a later stage, shows the inception of several characters that have not as yet appeared in the previous larvae. The axis is very strongly annulated; the anterior lobe is nearly as long as the 4 posterior annulations of the cephalon, and on each side there is a furrow representing the eye line of the adult; the free cheeks are present as narrow marginal plates including the genal spines; the pygidium shows 2 segments separated by a furrow.

The author figures *Sao hirsuta* Barrande, pl. 8, figs. 8-1.

Ordovician species.

Triarthrus becki Green.

Two protaspidan stages of this species have been noticed, differing chiefly in the size of the pygidium. Both agree in showing a strongly annulated axis, not expanded in front and terminating some distance within the margin.

Acidaspis tuberculata Conrad.

In general form the larvae resembles those of the second larvae stage of Sao, but the pygidium is shorter and the glabella does not expand and terminate in the anterior margin. No eye-line is present, but the eye lobes may be seen a little within the margin. The glabella has the characteristic number of annulations: margin provided with a row of denticles; genal angles extended into spines; pygidium with 4 spines.

The generic term *Arges* Goldfuss pre-occupied. See Ceratages, Gürich, 1901.

Arges consanguineus Clarke.

As the main details of structure in Acidaspis and Arges are so similar the young Arges show the same acceleration in the development of the spines and surface ornamentation and the retention of the primitive features of the glabella.

Proetus parvisculus Hall.

The illustrations of this species show strongly annulated axis with groove at each side; large, prominent anterior eyes, pygidial pleura indicated by faint grooves.

Dalmanites socialis Barrande.

The author gives 4 figures of this species.

The anaprotaspis stage showing the large, strongly annulated axis, the prominent anterior marginal eyes, mucronate genal angles. Pygidium of 3 segments.

Figures 1-8 in the text illustrate the young of *Agnostus nudus* Barr.

A. rex Barr., *Trinucleus ornatus* Sternb., *Hydrocephalus saturnoides* Barr. and *H. carens* Barr., *Olenellus (Mesonacis) asaphoides* Emmons.

——— The Monophology of Triarthrus.

Am. Jour. Sci., ser. 4, vol. 1, No. 4, 1896, pp. 251-256.

Geol. Mag., Decade 4, vol. 3, 1896, pp. 193-197, pl. 9.

——— Outlines of a natural classification of the Trilobites.

Part 1, Am. Jour. Sci., ser. 4, vol. 3, 1897, pp. 89-106, plate 3; continued on pp. 181-207.

Order Hypoparia.

Free cheeks, forming a continuous marginal ventral plate of the head, and in some forms also extending over the dorsal side at the genal angles.

Suture ventral marginal, or submarginal.

BEECHER (Charles E.)—Continued

Compound paired eyes absent; simple eyes may occur on each fixed cheek singly or in pairs.

Including the families Agnostidae Dalman, Fam. 2, Harpeididae Barrande, Fam. 3, Trinucleidae Barrande.

The first family includes the genera Agnostus Brongniart and Microdiscus (Emmons) Salter.

The second family, the genera Harpes, Goldfuss, Harpina Novák and Harpides Beyrich.

The third family, Trinucleus Lhwyd, Ampyx Dalman, Dionide Barrande, Endymionia Billings, Lonchodomas Angelin, Raphiophorus Angelin and Salteria W. Thompson.

Order B Opisthoparia.

Free cheeks generally separate, always bearing the genal angles.

Facial sutures extending forwards from the posterior part of the cephalon within the genal angles, and cutting the anterior margin separately, or rarely uniting in front of the glabella.

Compound paired holochroal eyes on free cheeks, and well developed in all but the most primitive families.

Fam. 4, Conocoryphidae Angelin, including the genera and subgenera.

Conocoryphe Corda Aneucanthus Ang. Atops Emmons, Avalonia Walcott, Bailiella Matthew, Bathynotus Hall, Carausia Hicks, Carmon Bar.

Ctenocephalus Corda, Dictyocephalites Bergeron, Eryx Ang., Harttia Walc., and Toxotis Wallerius.

Family 5, Olenidae Salter, including the genera.

Olenus Dalm. and the following genera and subgenera, which should fall into several sub-family or even family groups.

Acerocare Ang., Acrocephalites Wallerius, Agraulus Corda, Angelina Salter.

Anomocare Ang., Anopolenus Salter, Asaphelina Bergeron, Bavarilla Barr.

Bergeronia Matthew, Boeckia Brögger, Ceratopyge Corda, Chariocephalus Hall.

Corynexochus Ang., Crepicephalus Owen, Ctenopyge Linnarsson, Cyclognathus Linrs, Dikelocephalus Owen (Centropleura Ang.), Dorypyge Dames.

Ellipsocephalus Zenker, Elliptocephala Emmons, Euloma Ang., Eurycare Ang., Holmia Matthew, Hydrocephalus Barr. (young Paradoxides), Leptoplastus Ang., Liostracus Ang., Loganella Devine, Menocephalus Owen, Mesonacis Walc., Micmacca Matthew, Neseuretus Hicks, Olenelloides Peach, Olenellus Hall, Olenoides Meek, Oryctocephalus Walc., Paloeopyge Salter, Parabolina Salter, Parabolinella Brögger, Paradoxides Brong., Peltura Ang., Plutonides Hicks, Proceratopge Wallerius, Protagraulos Matthew, Protolenus Matthew, Protopeltura Brögger, Protypus Walc., Pterocephalia Roemer, Ptychaspis Hall, Ptychoparia Corda, Remopleurides Portlock, Sao Barr., Schmiditia Marcou, Solenopleura Ang., Sphaerothalmus Ang., Telepus Barr., Triarthrella Hall, Triarthrus Green, and Zacanthoides Walc.

A number of genera have been made the types of family divisions, as Paradoxides, Olenellus, Remopleurides, Ellipsocephalus, Ptychoparia, etc.

Family 6, Asaphidae Emmrich, including the genera and subgenera.

Asaphus Brong., Asaphellus Callaway, Asaphiscus Meek, Barrandia McCoy, Basilicus Slater, Bathyurellus Billings, Barthyuriscus Meek, Bathyurus Bill., Bolbocephalus Whitfield, Brachyaspis Salter, Bronteopsis W. Thompson, Dolichometopus Ang., Gerasaphes Clarke, Holasaphus Matthew, Homalalopecten Salter, Isotelus Dekay, Megalaspides Brögger, Megalaspis Ang., Niobe Ang., Ogygia Brong., Ogygiopsis Walc., Phillipsinella Novak, Platypeltis Callaway, Ptychopyge Ang. and Stygina.

The author includes under Illaenidae the genera Illaenus Dalm., Æglina Barr.,

BEECHER (Charles E.)—Continued

Bumastus Murch., Dysplanus Burmeister, Ectillaenus Salter, Holocephlina Salter, Hydralenus Salter, Illaenopsis Salter, Illaenurus Hall, Nileus Dalm., Octillaenus Salter, Panderia Volboth, Psilocephalus Salter, Symphysurus Goldfuss, and Thaleops Conrad.

Family 7, Proetidae Barrande.

Genera Proetus Steininger, Arethusina Barr., Brachymetopus McCoy, Celmus Ang., Cordania Clarke, Crotalurus Volb., Cyphaspis Burm., Dechenella Kayser, Griffithides Portl., Phaetonella Novák, Phillipsia Port., Prionopeltis Corda, Pseudophillipsia Gemmellaro, Schmidtella Tschernyschew, Tropidocoryphe Novak, and Xiphogomium Corda.

Family 8, Bronteidae Barrande.

Family 9, Lichadidae Barrande.

Genus Bronteus Goldfuss (Goldius DeKoninck).

Genera Lichas Dalm., Arctinurus Castelnau, Arges Golf., Ceratolichas Hall and Clarke, Conolichas Dames, Dicranogmus Corda, Homolichas Schmidt, Hoplolichas Dames, Leiolichas Schmidt, Metopias Eichwald, Oncholichas Schmidt, Platymetopus Ang., Terataspis Hall, Trochurus Beyrich and Uralichas Delgado.

Family 10, Acidaspidae Barrande.

Genera Acidaspis Murch., Ancyropyge Clarke, Ceratocephala Warder, Dicranurus Conrad, Odontopleura Emmrich and Selenopeltis Corda.

Order C, Proparia.

Free cheeks not bearing the genal angles; facial sutures extending from the lateral margins of the cephalon in front of the genal angles, inward and forward, cutting the anterior margin separately or uniting in front of the glabella.

Compound paired eyes, scarcely developed or sometimes absent in the most primitive family; well-developed and schizochroal in last family.

Family 11, Encrinuridae Linnarsson.

Genera Encrinurus Emmrich, Areia Barr., Cybele Loven, Dindymene Corda, Placoparia Corda and Prosopiscus Salter.

Family 12, Calymmenidae Brongniart.

Group 1, Calymmene Brong., and Calymenella Bergeron and Calymenopsis Munier-Chalmas and Bergeron.

Second Group, Homalonotus Koenig, Brongniartia Salter, Burmiesteria Salter, Trimerus Green, Ptychometopus Schmidt; Pharostoma.

Calymenopsis and Calymenella are closely related to Calymmene.

Family 13, Cheiruridae Salter.

Genera Cheirurus Beyrich, Actinopeltis Corda, Amphion Pander, Anacheirurus Reed, Ceraurus Green, Crotalocephalus Salter, Cyrtometopus Ang., Deiphon Barr., Diaphanometopus Schmidt, Eccoptocheile Corda, Hemisphærocoryphe Reed, Nieszkowskia Schmidt, Onycopyge Woodward, Pseudosphaerexochus Schmidt, Sphaerexochus Beyrich, Sphaerocoryphe Ang., Staurocephalus Barr., and Youngia Lindström.

Family 14, Phacopidae Salter.

Genera Phacops Emmrich, Acaste Goldf., Chasmops McCoy, Coronura Hall, Corycephalus Hall and Clarke, Cryphaeus Green (preoccupied for a genus of Coleoptera, 1833), Dalmanites Emm., Homalops Remele and Dames, Monorachos Schmidt, Odontocephalus Conrad, Pterygometopus Schmidt, Symphoria Clarke, and Trimerocephalus McCoy.

Note—Other subdivisions and classification of the Lichidae have been made by Gürich, and also by Reed.

The other families have been reclassified by Reed, Walcott and Raymond. Walcott remarks, in regard to Damesella, that the facial suture cuts the postero-lateral margin outside of the genal angle, so as to leave the genal angle on the fixed cheeks; the spine corresponding to the genal spine in other genera of the order Proparia is on the free cheeks.

BEECHER (Charles E.)—Continued

——— Trilobites in the Text Book of Palæontology (Zittel's).

Translated by Charles R. Eastman, London and New York, 1900, pp. 607-638.

——— Restoration of *Stylonurus Laconus*, a giant Arthropod from the Upper Devonian of the United States.

Am. Jour. Sci., ser. 4, vol. 10, 1900, pp. 145-150, plate.

——— The same.

Geol. Mag., Decade 4, vol. 7, 1900, pp. 481-485.

The author remarks that this specimen was collected in 1870, and loaned to Prof. Hall and described as *Eurypterus Beecheri* Hall, in 1884, in 36th Ann. Rep. N. Y. Mus. Nat. Hist. as *Stylonurus excelsior* as Hall's species. This paper appeared some months later than Claypole's paper, and the name *Dolichocephala Lacoana* has priority over *Stylonurus excelsior* and must be recognized.

Claypole's paper appeared in Proc. Am. Phil. Soc., vol. 21, April, 1883, to Jan., 1884.

——— Discovery of Eurypterid remains in the Cambrian of Missouri.

Am. Jour. Sci., ser. 4, vol. 12, 1901, pp. 364-366, plate.

Strabops Thacheri n. gen. et sp.

See also Geol. Mag., Decade 4, vol. 8, 1901, pp. 559-564, figure.

The generic name is in allusion to the inward turning or squinting of the eyes (squinting face).

The cephalthorax is comparatively shorter and wider than in Eurypterus; the eyes are further forward, nearer together and more oblique, and besides it has a telson, but 11 abdominal somites can be determined on the dorsal side, instead of 12 as in Eurypterus.

——— Ventral integuments of Trilobites.

Am. Jour. Sci., ser. 4, vol. 13, 1902, pp. 165-174, with 3 plates; also Geol. Mag., Decade 4, vol. 9, 1902, pp. 152-163, with 8 figures.

The author illustrates *Triarthrus Becki* Green, *Ptychoparia striata* Emm., *Asaphus magistus* Locke, and *Calymmene senaria* Conrad.

——— Note on a new Xiphosauran from the Upper Devonian of Pennsylvania.

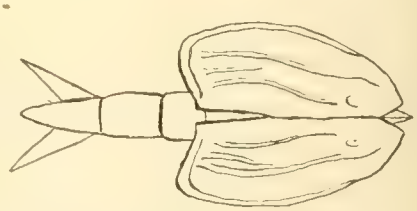
Am. Geol., vol. 29, 1902, pp. 143-146.

Prestwichia Randalli n. sp., with figure.

——— On Palæozoic Phyllopocarida from Pennsylvania.

Quart. Jour., Geol. Soc., vol. 58, 1902, pp. 441-449, plates.

Tropidocaris bicarnatus Beecher, *T. alternata* Beecher, *Elynocaris siliqua* Beecher.



Tropidocaris Bicarinata Beecher

Benden Van (M. E.) On the systematic position of the King Crabs and Trilobites.

Ann. Mag. Nat. Hist., ser. 4, vol. 9, 1872, p. 98.

Bernard (Henry M.) Trilobites with antennae at last.

Nature, 1903.

——— Systematic position of the Trilobites.

Geol. Mag., Decade 5, vol. 1, 1894, p. 230.

The author remarks the trilobites may be briefly described as fixed specialized stages in the evolution of the Crustacea, from an annelidan ancestor, with its mouth bent round ventrally, so as to use its parapodia as jaws.

——— Application of the sand blast for the development of Trilobites.

Geol. Mag., Decade 4, vol. 1, 1894, p. 553.

Berkey (Charles P.) Geology of the St. Croix Dalles.

Am. Geol., vol. 21, pp. 270-294, plates 18-21, 1898.

The author includes and illustrates the following Trilobites:

Agraulus convexus Whitf., with var. A and B, *A. hemisphericus* n. sp.

Ptychoparia calymenoides (Whitf.). The genotype of Menomonia new genus by Walcott, 1916.

Cheilocephalus n. gen.

The author figures the glabella and fixed cheeks. Cephalic shield semi-circular, strongly convex, about equal to one-fourth part of a spheroid (front limb), formed by a narrow ring projecting at a right angle beyond the general surface of the shield. Glabella broad, convex anteriorly, slightly convergent and reaching to the narrow marginal rim; surface nearly smooth with two pairs of scarcely perceptible furrows; marginal grooves not strongly marked; faint occipital ring, but more strongly marked on the cheeks. Fixed cheeks, broad and conforming to the general spherical outline; the posterior margin developed in a spine-like projection a little removed from the glabella. Eyes a little anterior to the middle and remote from the glabella. Facial sutures extend from the eyes forward almost parallel to the side of the glabella and backward, with a double curve to the genal angle.

Cheilocephalus St. Croixensis n. sp. (Facial suture like Cyclognathus.)

The author also figures *Dikelocephalus misa* Hall, referred by Walcott to the genus Amomocare.

Berjeron (J.) Notes Palaeontologiques.

Bull. Soc. Geol. France, 3rd ser., vol. 23, 1895, p. 465, plates 4-5.

Calymenopsis Filacovi n. gen. et sp. *Amphion Escorti* n. sp.

Dicellocephalus? Villerbruni n. sp. *Asaphelina Barroisi* Mun. Ch. et J. Berg. *Ogygia Lignieresti* n. sp. *Æglina Sicardi* n. sp. *Æglina? Savini* n. sp. *Dictyocephalus Villerbruni* n. gen. et sp.

The author remarks that the new genus *Calymenopsis*, "Il est caracterise par la presence de pointes genales par la forme de la grande suture; par le presence de cavites dans le sillon anterieur, cavites qui semblent etre comparable a cellos du limbe des *Trinucleus;* par la presence d'une bande oculaire; enfin par la forme en pyramide des joues mobiles."

——— Notes Paléontologique—Crustacés iv étude de quelques Trilobites de Chine.

Bull. Soc. Geol. France, 3rd ser., vol. 27, 1899, pp. 499-515. Plate.

Calymmene? sinensis n. sp. This species forms the genotype of *Blackwelderia* Walcott, new genus. *Agnostus Douvillei* n. sp. *Olenoides Leblanci* n. sp.

Dicellocephalus? sinensis n. sp. Walcott Cambrian Fauna of China, p. 35, places this species under his new genus *Damesella.*

Drepanura Premesnilli n. gen. et sp. Compare *Bathynotus. holopyga* Hall.

Arthricocephalus Chauveaui n. gen. et sp.

"La caracteristique de cette forme est la structure annelee de tout son corps et en particulier de la glabella. Celle-ci semble formee d'anneaux superposes et a ce point de vue seulement elle rappelle la disposition caracteristique du genre *Olenellus.*"

Bézier (T.) On *Niloeus Beaumanti* Rouault, 1847.

Palæontologia Universalis Fasc. 3, ser. 2, 1907, p. 119, plate.

The species was described by Rouault. Bull. Soc. Geol. Fr., 2d ser., vol. 14, 1847, pp. 321 and 326.

Distinguished from *Niloeus Armadillo* by its large pygidium.

——— On *Prionocheilus Verneuili* Rouault, 1847.

Palæontologia Universalis Fasc. 3, ser. 2, 1907, p. 120, plate.

The author refers *Calymmene pulchra* Barr., to this species, and refers Corda genus Pharostoma to Rouault's older genus Prionocheilus, which was described by Rouault in Bull. Soc. Geol. Fr., 2 ser., vol. 4, 1847, pp. 320-321, pl. 3, figs. 3 and 3a.

As *Prionocheilus Verneuili*, the holotype shows spines on the outer margin of the head.

The species has been referred to Calymmene by Barrande.

To Pharostoma by Corda, Pompecki and Angelin.

The name of *Verneuili* for a species of Calymmene has been used by d'Orbigny, 1842. Tromelin and Lebesconte, 1876, Assoc. Fr. Sc., Congres Nantes, p. 629, changes the name from *Calymmene Verneuili* to that of *Calymmene Prionocheili*.

Bigot (A.) Catalogue critique de la collection Defrance, conservée au Musée d'histoir Nat. de Caen.

Bull. Soc. Normand, vol. 8, pp. 250-273. Trilobites, pp. 264-65.

Alexander Bronginart and A. G. Demarest used the collection of the Museum in making up their celebrated work on Fossil Crustaceans in 1822.

The collection contains Defrance's original of figs. 2f and 2g.

Calymmene Tristani, which is reproduced, Plate 1A Palæontologia Universalis, by M. Pompejck, in 1903.

The *Ogygia Guettardi* Brong. was reproduced by Oehlert in Palæontologia Univ.

Bolton (Herbert). On the occurrence of a Trilobite in the Skiddaw Slates of the Isle of Man.

Geol. Mag., Dec. iii, vol. 10, 1893, pp. 29-31.

Æglina or Asaphus.

See also Mem. Geol. Sur. United Kingdom, The Geol. Isle of Man, 1902, p. 93.

Bigney (Andrew J.) A new bed of Trilobites.

Indiana Acad. Sci. Pro., 1910, p. 139-1911.

Records the discovery of Calymmene bed in Richmond formation.

Bolton (H.) On faunal horizons in the Bristol Coalfield.

Quart. Jour. Geol. Soc. London, vol. 67, p. 316, 1911, pl. 27.

Palæontological Notes, Ostracoda and Phyllopoda, on p. 324.

The author figures the following species:

Estheria tenella Jordan, *Bairdia* cf. *amplex* Reuss, *Leaia Leidyi* Lea, var. *salteriana* Jones.

Bonnema (J. H.) Beträge zur Kenntniss der Ostrakoden der Kuckersschen Schicht.

Mitteilungen aus dem Min. Geol. Inst., vol. 2, part 1, Leipzig, 1909, 84 pp. with 8 plates.

The author gives the literature of this family, and describes and figures the following genera and species:

Primitia Tolli nov. sp., *P. Molli* nov. sp., *P. dentifera* nov. sp., *P. rossica* nov. sp., *P. decumana* nov. sp., *P. Kuckerstana* nov. sp., *P. Kapteyni* nov. sp., *P. Esthonica* nov.

sp. *Primitiella Kuckersiana* nov. sp. *Tetradella Calkeri* nov. sp.; also *convexa* n. sp. et nov. var. *Ctenobolina carinata* Krause, *C. Kuckersiana* nov. sp. *Ceratopsis Schmidti* n. sp., *C. cornuta* Krause. *Strepula Kuckersiana* nov. sp., also var. *acuta*. *Ulrichia* cf. *bidens* Krause, *U. Kuckersiana* n. sp. *Macronotella Kuckersiana* nov. sp. *Bollia minor* Krause var., *Kuckersiana* nov. var., also var. *robusta*. *Bollia ornata Krause*, also var. *latimarginata* nov. var., *B. granulosa* Krause. *Entomis oblonga* Steusloff var., *Kuckersiana* nov. var., *E. variolaris* nov. sp., *E. obliqua* Krause var. *Kuckersiana* nov. var., *E. flabellifera* Krause, *E. quadrispina* Krause. *Cytherellina Ulrichi* nov. sp., *C. Jonesii* nov. sp., *C. Krausei* nov. sp., *C. Ruedemanni* nov. sp. *Leperditia (Cypridina) ovulum*, referred to *Primitia Tolli* n. sp. *Leperditia minuta* Eichw., referred to *Cytherellina Ulrichi* n. sp. *Beyrichia obliquejugata* Schmidt to *Ceratopsis* sp. *Beyrichia complicata* Salter, referred to *Tedradella Kuckersiana* n. sp., *B. stangulata* Salter to *Bollia minor* Kr. var. *Kuckersiana, B. strangulata* var., *B. Jones* to *Bollia ornata* Kr. or *Entomis*.

Bornemann (J. G.) Die Versteinerungen des Cambrischen Schichensystems der Insel Sardinien.

N. Act k. Leop. Carl d. Acad. d. Natur., vol. 56, No. 3, 1891.

Under the new generic name of Olenopsis the author includes a genus which differs from Olenus in the form of its small, rounded pygidium with an unjointed axis; the head is semicircular in front and not straight as in Olenus; it has also a conical smooth glabella, with 14 or 15 thorax segments.

The genus has been referred by Frech *Lethaea geognostica*, I Theil. *Lethaea palaeozoica*, 2 Bd., I Lieferung, p. 41, to *Olenellus* sub. genus *Holmia*.

The author describes *Olenopsis Bornemanni* n. sp., *O. Zoppii Menegh., O. longispinatus* n. sp., *O. micruroides* n. sp., and *O. maximus*.

Metadoxides torosus Menegh. n. gen. et sp.

This genus is similar to *Paradoxides* with numerous thoracic segments and a small pygidium. The head is short and wide; the front margin nearly straight; the glabella is similar to that of the Olenidae, and has three oblique furrows, which do not extend to the center.

Metadoxides armatus Menegh., *M. Bornemanni* Menegh., *M. arenarius* n. sp.

Matthew, in Studies on Cambrian Fauna, No. 3, p. 87, classifies the genus *Metadoxides* as follows:

1—Species having a widely expanded front to the cephalic shield; somewhat prolonged eye lobes; short posterior extension of the dorsal suture. No costae on the side lobes of the pygidium.

Catadoxides n. subgen., type *C. magnificus* Matt.

2—Species having a compacted front to the cephalic shield, short eye lobes, prolonged posterior extension to the dorsal suture.

a—No costae on the side lobes of the pygidium.

Metadoxides sen stric., type *M. torosus*.

b—One or more pair of costae on the side lobes of the pygidium.

Anadoxides n. subgen., type *A. armatus*.

The following species are also included in Bornemann's paper:

Paradoxides Gennarii Menegh., *P. asper* n. sp., *?P. ingens* n. sp., *?P. bifidus* n. sp., *? Paradoxides* sp. *Olenellus solitarius* n. sp.

? Peltura inflata n. sp. *Ptychoparia laticops* n. sp., *? P. Adamsi* Bill., *P. enantiopa* n. sp. *Sao sarda* n. sp. *Meneghinella* n. gen., *M. serrata* n. sp.

The glabella has four cross furrows, with a center row of spines.

Arionellus ? dubius n. sp., *A. zancanthoides*. *Anomocare arenivagum* Menegh. *Neseuretus? discurus* n. sp. *Giordanella* n. gen.

The species of this genus resembles in structure of the thorax those of *Illaenus,* from which they differ by the more arched axis, and the side spines of the pygidium.

Angelina differs from *Giordanella* in its flat head, and the margin around it; also in the size of its pygidium.

Giordanella Meneghinii Bormen., *G. dilatata* n. sp., *G. elongata* n. sp.

Boulay (M. L'abbe). Sur un nouveau genre de Trilobite dans le terrain. Houiller du nord de la France.

Ann. Sci. Bruxelles, 4 Anne, 1879-80, Memori, p. 277-280.

Under the new generic name of Anthracopeltis, the author describes and illustrates a pygidium as *Anthracopeltis Crepini.*

The pygidium resembles that of Phaeton Barrande, but may be distinguished by the shape of the axis, also by a groove which runs around the tail near the base of the spines.

Boule (M.) Sur des debris d'Arthropleura trouvés en France.

Bull. de la Soc. de l'Industrie Minerale, 3rd ser., tome 7, 4 livr, 1893, pp. 619-638, plates 54-55.

Brodie (P. B.) On the Passage beds in the neighbourhood of Woolhope, Herefordshire, and on the discovery of a new species of Eurypterus and some new Land plants in them.

Geol. Mag., Decade 1, vol. 8, 1871, p. 230.

The author describes as the passage beds between the Silurian and Old Red sandstone formation near Woolhope, a series of shales and sandstones. The Olive shales contain several crustacean fossils, including *Pterygotus Banksii,* and a new Eurypterus named by Henry Woodward *Eurypterus Brodiei.*

Branson (E. B.) The fauna of the residuary Auburn Chert of Lincoln County, Missouri.

Trans. Acad. Sci. of St. Louis, vol. 18, No. 4, 1909, pp. 39-49, pl. 7.

The author describes as new *Pterygometopus Lincolnensis,* which differs from *P. choraccous* in the absence of genal spines, and slightly in the shape of the first lateral furrow of the glabella from *P. intermedius* Walc., which he figures on pl. 8, fig. 20.

Brögger (W. C.) Ueber die Verbreitung der Euloma Niobe Fauna.

Nyt. Mag. Natv., vol. 35, 1896, pp. 164-240.

The author refers to the new genus *Dikelokephanina.*

Centropleura dicraeura Ang. *Dikelocephalus furca* Salt. *Asaphelina Barroisi* Mun-Chalm et Berg. and *Dictyocephalites Villebruni* Berg., to this genus.

Under the new genus Apatokephalus, the author places *Tril serratus* S. & B. *Centropleura angusticauda* Ang. (probably a variety of Apatokephalus serrata Brögg., p. 211).

Dik. finalis Walc., *D. Schlotheimi* Bill. *(Remopleuridesi Schlotheimi* Bill., 1865.) *Dikelocephalus Magnificus Conocorphyhe invita,* Salter.

Bureau (L.) Notice geol. sur Loire Inférieure, 1900.

The author gives a fig. 23 of *Calymmene pulchra* Barr.

Bezier refers it to *Prionocheilus Verneuili* Rouault.

Burling (L. D.) The Albertella Fauna in the Middle Cambrian of British Columbia.

Am. Jour. Sci., 4th ser., vol. 42, 1916, p. 469.

Albertella Boszworthi and *A. Helena* Wal.

Burr (Henry T.) A new Lower Cambrian fauna from Eastern Massachusetts.

Am. Geol., vol. 25, 1900, pp. 41-50.

The fossils described from a red slate and impure limestone from North Weymouth, Mass.

Olenellus (Holmia) *bröggeri* Walc., *O. (Mesonacis) asaphoides* Emm. *Olenellus* sp. *Metadoxides magnificus* Matt. *Agraulus (Strenuella) strenuus* Bill. var. *nasutus* Walc. *Microdiscus* cf., *M. Helena* Walc. *Leperditia* cf., *L. solitaria* Barr.

Burhenne (H.) Fauna d. Tentaculitenschiefer in Lahngebiet bes d. Schiefer v. Leun bei Braunfels. 1899.

Proctus laevigatus and *granulosus,* pl. 1, fig. 1-6; *Proctus Holzapfeli* referred by Richter to *P. cornutus.*

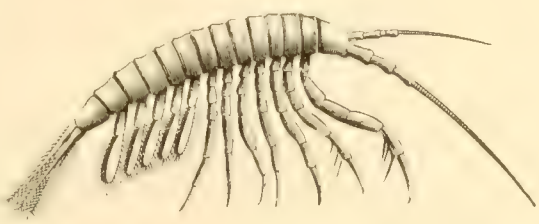
Cyphaspis hydrocephala Roemer.

Calman (W. J.) On *Pleurocaris* a new Crustacean from the English Coal Measures.

Geol. Mag., Decade v, vol. 8, 1911, p. 156. Fig. in text.

Pleurocaris annulatus g. et sp. n.

The specimen is without a carapace, with at least 7 of the thoracic somites distinct and provided with horizontally expanded pleural plates; with at least 7 pairs of the thoracic appendages, not greatly differing in size; with the abdomen longer than the thorax; with the telson and uropods forming a tail fan—the former distinct from the last somite and tapering to a sharp point, the latter with long, narrow rami.



Acanthotelson Simpsoni Meek and Worthen

The author includes the genus in Syncarida allied to the genus *Acanthotelson* Meek and Worthen.

Calman (W. T.) On some Crustacea of the division Syncarida from the English Coal Measures.

Geol. Mag., Decade v, vol. 8, No. 11, 1911, pp. 488-495, figures 1-5.

The author regards the genus Preanaspides Woodward, as a synonym of Palæocaris Meek and Worthen.

Figures and describes *Palaeocaris praecursor* H. Woodw., also *Palaeocaris typus* after Packard's figure of the species.

The author also gives some additional notes regarding *Pleurocaris annulatus,* with a figure of the restoration of dorsal surface of the head region.

Calvin (Samuel). Description of *Asaphus susac.* Calvin in MS.

Whitfield Geol. Wisconsin, vol. 4, p. 236, pl. 5, fig. 3, and pl. 10, fig. 8, from the Trenton Group.

——— Description of *Isotelus florencevillensis* n. sp.

Iowa Geol. Sur., vol. 13, 1902, p. 46, foot-note, from the Maquoketa or Hudson River shales.

This is the rather short and broad trilobite, with rounded cephalon and pygidium, which Clarke Geol. Pal., vol. 3, part 2, p. 708, referred to *Isotelus susae*.

Cardot (H.) and **Legendre** (R.) Nouvelles traces d'autotomie chez des Crustaces fossiles.

Bull. Mus., Paris, 1912, pp. 131-132.

Carruthers (William). Note on some supposed fragments of a Eurypterus in Dr. Henry Woodward's British Fossil Crustacea Merostomata.

Mon. Palaeont. So., pp. 168-71.

The author remarks that the specimens figured and described by Salter as portions of a Eurypterus, are fragments of a large Equisetaceous plant.

Chapman (Frederick). On a new species of Leperditia from the Silurian of Yaas, New South Wales.

Proc. Roy. Soc. Victoria, vol. 22, pp. 1-5, plates 1 and 2.

Leperditia shearsbii nov.

——— New or little known Victorian Fossils in the National Museum, Part XIV. On some Silurian Trilobites.

Proc. Roy. Soc. Victoria, vol. 24, 1912, pp. 293-300, plates 61-63.

The author describes:

Ampyx parvulus Forbes var. *Jikaensis* nov., *A. yarraensis* nov. *Illaenus jutsoni* nov. The Victorian species differs in ornamentation of the glabella from *Illaenus Davissi*. It has a narrow and rounded median ridge, extending along the summit of the glabella, tapering off into a mere thread before reaching the anterior margin.

Encrinurus (Cromus) spryi nov. *Homalonotus vormer* nov.

——— New or little known Victorian Fossils in the National Museum, Part XVIII. Some Yeringian Trilobites.

Proc. Roy. Soc. Victoria, vol. 28, 1915, pp. 157-171, plates 14-16.

The author includes eleven species of Trilobites in this paper:

Goldius greenii nov., which he compares with *Bronteus oblongus* Corda. *Goldius Cresswelli* nov. *Proetus eurycops* McCoy. *Cyphaspis Browningensis* Mitchell, *C. Lilydalensis* nov. of the *Cyphaspis Burmeisteri* type, *C. yassensis* E. & M. *Calymmene angustior* nov.

Compares *C. tuberculosa* and other species.

The lateral riblets of the pygidium in *C. angustior* are furrowed or bifurcated distally, but in *C. tuberculosa* they are simple. *Calymmene Blumenbachi* Brong. Refers *C. duplicata* (Murch.) Jenkins, 1879, p. 27, pl. 6, fig. 4, to this species.

Cheirurus Sternbergi Boeck. *Phacops Crossleii* E. & M., *P. serratus* Foerste.

Chevillard (J. L.) Trilobites du Devonien du Mount de la Revenue.

Bull. Soc. Geol. de France, 2d ser., vol. 24, 1866-67, pp. 124-126.

Not descriptive.

The author remarks that *Phacops laevis* Münst. is very much like *Phacops cryptophthalmus* Emmrich.

Chmielewski (Czeslaw). Die Leperditien der obersilurischen Geschiebe des Gouvernement Kowno und der Provinzen Ost und Westpreussen.

Phys. ökonomischen Ges zu Königsberg, 1900, 37 pp., 3 plates.

The author describes the following species:

Leperditia Hisingeri Fr. Schmidt var., *angulata* Lebedew, *L. lithuanica* n. sp. and var. *intermedia, L. Dossi* n. sp., *L. Hisingeri* var. *abbreviata* Schmidt, *L. baltica* His., *L. phaseolus* His. Stammform, *L. phaseolus* His. var. *Angelini* Schmidt, also types and var. *lata* n. var., *L. phaseolus* His. var. *ornata* Eichw., included under Group A.

His. Group B, includes *Leperditia gregaria* Kiesow and var. *coccinnella* n. var., *Leperditia gregaria* var. *tumulosa* n. var. and var. *conoidea* n. var. with var. *seimgalliensis* n. var. *Leperditia Schellwieni* n. sp., *L. gigantea* Roemer and var. *Poniewieshensis* n. var. *Leperditia* sp. cf. *tyraica* Schmidt. *Leperditia Keyserlingi* Schmidt and *L. baltica* var. *Eichwaldi* Schmidt.

Clarke (J. C.) Relation of the Palæozoic Arthropods to the Strandline.

Bull. Geol. Soc. America, vol. 22, No. 2, pp. 279-280, 1911.

Clarke (John M.) Notes on some Crustacea from the Chemung Group of New York.

49th Ann. Report N. Y. Museum, vol. 11, 1895, pp. 729-738.

Pephicaris horripelta n. gen. et sp. *Bronteus serescens* n. sp.

——— The stragraphic and faunal relations of the Oneonta sandstone and shales, the Ithaca and Portage Groups in Central New York.

49th Ann. Report N. Y. Museum, vol. 11, 1895, Part 2, p. 69, fig.

Rhinocaris ? bipennis n. sp.

—— Upper Silurian fauna of the Rio Trombetus, State of Para, Brazil, and Devonian Mollusks from the State of Para.

Archiv. Mus. Nacional, Rio de Janeiro, vol. x, 1899.

Primita minuta, Eichw. *Bollia lata,* Vanuxem.

Rhinocaris Columbina

——— *Eucrustacea* (pars) *acerta.*

Text Book of Palæontology by A. von Zittel. Translated by Charles R. Eastman, London and New York, 1900, pp. 639-658.

——— The Oriskany fauna of Becaft Mountain, Columbia Co., New York.

Memoirs New York State Museum, vol. 3, No. 3, Albany, 1900, 9 plates.

Dalmanites (Synphoria) stenmatus n. sp., *D. (Synphoria) stemmatus* var. *convergens* n. var. *D. phacoptyx* H. and C., *D. bisignatus* n. sp. *Phacops correlator* n. sp., *P. Logani* Hall. *Cordania becraftensis* n. sp., *C. Hudsonica* n. sp. *Cyphaspis minuscula* Hall. *Proetus Conradi* Hall. *Acidaspis tuberculata* Conrad. *Lichas* cf. *pustulosus* Hall. *Homalonotus* sp. *Beyrichia* sp.

——— Appendix 3. Notes on Palæozoic Crustaceans. The genus *Pseudoniscus* in the *Eurypterus* beds below and above the Gypsum and Salt beds of the Salina stage in New York.

Ann. Report State Palæontologist, 1900.

Pseudoniscus Roosevelti n. sp.

CLARKE (J. M.)—Continued.

——— Phyllocardia from the Black shales at the base of the Salina beds in Western New York.

Ann. Report State Palæontologist, 1900, pp. 92-110.

Ceratiocaris (Limnocaris) praecedens n. sp. *Emmelezoe decora* n. sp.

——— The occurrence of the Phyllopod Crustacean *Estheria membranacea* of the Old Red Sandstone of Northern Scotland and Northwestern Russia in the Oneonta.—Catskill sediments of Eastern New York.

Ann. Report State Palæontologist, 1900, pp. 103-110, plate 4.

Estheria Ortoni n. sp.

——— Limestone of Central New York interbedded with bituminous shales of the Macellus, with notes on the nature and origin of their faunas.

Bull. N. Y. Museum, vol. 49, 1901, pp. 115-138, plate 8.

Not descriptive. List of Fossil Crustacea.

—— and Ruedemann (R.) Guelph fauna in the State of New York.

N. Y. State Museum, Mem. 5, 1903.

The authors describe and illustrate *Leperditia balthica* Hisinger var. *guelphica* Jones. *Calymmene niagarensis* Hall; also a species of Dalmanites and Proetus.

——— Percé: A brief sketch of its geology.

Bull. New York Mus., No. 80, pp. 134-171, 1905.

Represents an incomplete cephalon of *Dicranurus limenarcha*, on p. 153.

——— some new Devonic Fossils.

Bull. 107, N. Y. State Mus. Geological Papers, 1907, pp. 153-291.

Trilobites: *Dalmanites griffoni* n. sp., fig., *D. coxius* n. sp., fig., *D. dolbeli* n. sp., fig., *D. Lowi* n. sp., fig., *D. percecnsis* n. sp., fig., *D. Veiti* n. sp., fig., *D. Whitcavesi* n. sp., fig., *D. Gaveyi* n. sp., fig., *D. ploratus* n. sp., fig., *D. (Probolium) Bairdi* n. sp. fig., *D. (Probelium) Esnoufi* n. sp., fig. *Phacops Logani* var. *gaspensis* n. sp., fig., *P. (Phacopidella) Mylanderi* n. sp., fig. *Bronteus Barrandii*, Hall, var. *major*, fig. *Lichas (Gaspelichas) forillonia* n. sp., fig., *L. bellamicus* n. sp., fig. *Ceratocephala robinia* n. sp., fig. *Cordania gaspiou* n. sp., fig.

——— The Eurypterus shales of the Shawangunk Mountains in Eastern New York.

Bull. 107, N. Y. State Mus. Geological Papers, 1907, pp. 295-310, 8 plates.

Eurypterida: *Eurypterus maria* n. sp., *E. myops* n. sp., *E. ? cicerops* n. sp., *E. ? cestrotus* n. sp.

Genus Hughmilleria *H. shawangunk* n. sp.

Genus Pterygotus *P. ? otisius* n. sp. *Stylonurus* sp. Phyllocardia.

——— Early Devonic History of New York and Eastern North America.

N. Y. State Mus., Men. 9, pt. 1, 366 pp., 48 plates, 1908.

Fauna of the St. Alban beds; *Phacops logani* Hall. *Dalmanites griffoni* nov., *D. coxius* nov. *Bronteus barrandii* Hall. *Cordania cyclurus* Hall and Clarke.

CLARKE (J. M.)—Continued.

Fauna of the Grade Greve Limestones. *Phacops logani* Hall and var. *gaspensis* nov. *Dalmanites micrurus* Green, *D. dolbeli* nov., *D. lowi* nov., *D. veiti* nov., *D. Whiteavesi* nov., *D. perceensis* nov., *D. emarginatus* Hall, *D. gaveyi* nov., *D. (Probolium) bairdi* nov., *D. (P.) esnoufi* nov., *D. phacoptyx* H. & C.

Proetus phocion Billings. *Cordania becraftensis* Clarke, *C. gasepion* nov. *Lichas bellamicus* nov. *Lichas (Gaspelichas) forillonia* nov. *Ceratocephala robinia* nov. *Aparchites* nov. *Bythocypris* sp. nov. *Phacops (Phacopidella) correlator* Clarke.

——— Early Devonic History of New York and Eastern North America.

N. Y. State Mus., Mem. 9, part 2.

The author illustrates *Dalmanites micrurus* Green Proetus sp. *Bronteus Barrandii* Hall. *Pterygotus* sp. from the Dalhouse Beds.

From the Moose River sandstone the following Crustacea:

Homalonotus cf. *vanuxemi* Hall. *Dalmanites pleuroptyx* Green, *D. ploratus* Clarke Dalmanites sp.

From the Chapman sandstone: *Phacops (Phacopidella) mylanderi* Clarke. *Homalonotus vanuxemi* Hall. *Dalmanites* cf. *micrurus* Green.

New York Oriskany *Dalmanites emarginatus* Hall.

——— and Ruedemann (Rudolf). Mode of life of the Eurypteridae.

Science, new ser., vol. 32, p. 224, Aug. 12, 1910.

——— and Ruedemann (Rudolf). The Eurypterida of New York.

Memoir 14, New York State Museum, vol. 1, Text vol. 2, plates, 1912, 638 pp., 88 plates, 121 text figures.

Reviewed in Am. Jour. Sci., vol. 35, No. 208, 1913, p. 458.

The reviewer remarks (Schuchert): "It is truly a monumental work and a model for all palæontologists to follow."

In this work one can study Eurypterida from any view point permitted the palæontologist. Here we find their chronology, their development from baby stages, prophetic of unknown ancestors, to adults; and their relations to scorpions, horseshoe crabs, Trilobites and even to hypothetic annelids.

The authors illustrate in text and plates the following species:

Strabops thacheri Beecher.

Eurypterus.

The American species of Eurypterus readily fall into three subdivisions:

(A) Those that groups themselves around *E. remipes.*

(B) Those that vary in different directions from this group, but are approximately contemporary—E. Dekayi, etc.

(C) The later Carbonic species.

Under this genus the authors describe:

Eurypterus remipes DeKay, *E. lacustris* Harlan, *E. lacustris* Hall var. *pachychirus* Hall, *E. DeKayi* Hall, *E. maria* Clark. This species differs from American congeners, due to the terete form of the body that apparently is without preabdominal expansion.

Eurypterus pygmaceus Salter differ but slightly. *Eurypterus megalops* nov., *E. microphthalmus* Hall. The authors refer *E. eriensis* Whitfield, to this species. *Eurypterus pittsfordensis* Sarle, *E. (Dolichopterus ?) prominens* Hall, *E. pustulosus* Hall. Authors refer *E. giganteus* Pohlman and *E. globicaudatus* Pohlman to this species. *Eurypterus pristinus* nov., *E. ranllarva* nov., *E. ? (Dolichopterus ?) stellatus* nov., *E.*

CLARKE (J. M.) and RUEDEMANN (R.)—Continued

(Onychopterus) Kokomoensis Miller and Gurley. This is subgenus proposed for this species.

The authors classify *Eurypterus Boylei* Whiteaves under a new subgenus *Tylopterus*.

Eurypterus (Anthraconectes) mazonensis Meek and Worthen. *Eusarcus* Grote and Pitt. *Eusarcus scorpionis* Grote and Pitt. The authors refer *E. grandis* G. & P. to this species. *Eusarcus newlini* Claypole. The authors refer *Eurysoma newlini* and *Carcinosoma newlini* Claypole to this species. *Eusarcus ? cicerops* Clarke, *E. ? longiceps* nov., *E. triangulatus* nov. *Dolichopterus macrochirus* Hall, *D. frankfortensis* nov., *D. latifrons* nov., *D. otisius* Clarke, originally described under the genus pterygotus; *D. siluriceps* nov., the *Eusarcus scorpionis* Pohlman, 1886, *D. testudineus* nov., *D. stylonuroides* nov.

Genus *Stylonurus* Page. The authors illustrate *S. elegans* Laurie and *S. logani* Woodward, also *S. macrophthalmus Laurie*. They divided the genus into subgenera.

(A) Stylonurus type *S. logani* Woodward, etc.

(B) Ctenopterus type *Stylonurus cestrotus* Clarke, etc.

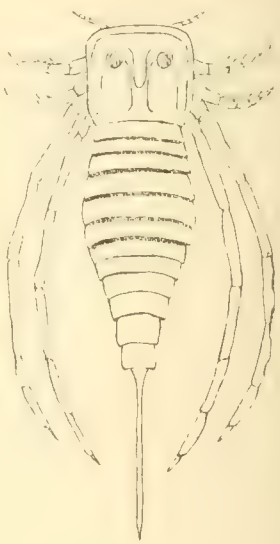
(C) Tarsopterus type *S. scoticus* Woodward.

Stylonurus (Ctenopterus) excelsior Hall. .....

The author refers *Dolichocephala lacoana* Claypole, 1883, and *S. lacoanus* Beecher, 1900, to this species.

(Drepanopterus) type *S. lobatus* Laurie.

Stylonurus limbatus nov., *S. (Ctenopterus) multispinosus* nov., *S. myops* Clarke. *Stylonurus beecheri* Hall, described as *Eurypterus beecheri*, Hall, 1884; *S. wrightianus* Dawson, described as *Equisetides wrightiana* Dawson, 1881. Subgenus *Drepanopterus* Laurie. The authors figure *D. pentlandicus* Laurie, *D. longigaudatus* nov.



Stylonurus Logani Woodward

Echinognathus Walcott, *E. clevelandi* Walcott.

Megalograptus Miller, *M. welchi* S. A. Miller. This was described as a Graptolite by Miller, 1874.

Family Pterygotidae:

Genus *Hughmilleria* Sarle, 1902, *H. socialis Sarle* and var. *robusta, H. magna* nov., *H. shawangunk* Clarke.

Pterygotus Agassiz:

The authors figure a restoration of *Stylonurus powelei* and *Pterygotus angelicus*, fig. 70. Describe and illustrate *Pterygotus macrophthalmus* Hall, to which they refer *P. osborni* Hall, *P. atlanticus* nov., *P. buffaloensis*, Pohlman emend. The authors refer *P. cummingsi* Grote and Pitt, 1877, *P. acuticaudatus* Pohlman, 1881, *P. quadraticaudatus* Pohlman, *P. macrophthalmus* Pohlman, 1881, and *P. bilobus* (Huxley and Salter) Pohlman, 1881, to this species. *Pterygotus cobbi* Hall, *P. (Erettopterus) globiceps* nov., *P. (Erettopterus) gandis* Pohlman emend.

This is the *Ceratiocaris grandis* Pohlman, 1883, *P. monroensis* Sarle, *P. (Eusarcus) nasutus* nov., *P. prolificus* nov.

Remarks on *Beltina danai* Walcott.

The authors are not convinced that the fragments of this genus described are those of merostomatus.

Note on *Proscorpius osborni* Whitfield.

CLARKE (J. M.) and RUEDEMANN (R.)—Continued

The authors remark that Eusarcus and the Siluric scorpions are so much alike in their body form, they may be assumed to have had similar habits.

The genus *Hastimima* White, 1909.

This genus was established for a few carbonic plants from Brazil. Seward, 1909, and Woodward refer similar fragments to the Eurypteridae. The authors give figures of *Hastimima whitei*.

Note on *Sidneyia inexpectans* Walcott.

The authors remark that the suborder Limulava differs from the Eurypteridae, to which it is most nearly related, in having a large epistoma similar to that of the Trilobita.

Eurypterids from the Normanskill shale of New York.

Eurypterus chadwicki nov. *Eusarcus linguatus* nov. *Dolichopterus breviceps* nov. *Stylonurus modestus* nov. *Pterygotus (Eusarcus) nasutus* nov., *P. normanskillensis* nov.

The authors give notes on the Eurypterids from the Shawangunk grit of the Delaware Water Gap, Pennsylvania, and describe as new *Eusarcus vaningeni* from the Salina formation.

Notes on Anthraconectes.

The authors investigated the types of C. E. Hall and James Hall, Pennsylvania Carbonic species, now in Chicago Univ., and make some notes on *Eurypterus (Anthraconectes) mansfield* C. E. Hall, *E. pennsylvanicus* C. E. Hall.

The volume closes with a note and figure on the ventral surface of the cephalothorax of Hughmilleria, and a note on *Pterygotus Cobbi* var. *juvenis* nov.

—— A notable Trilobite from the Percé rock.

New York State Museum Bull. 164, 1913, p. 138.

The author illustrates Plate *A. Homalonotus perceensis*.

——— Illustrations of the Devonian fossils of Southern Brazil and the Falkland Islands.

New York State Museum Bull. No. 164, 1913, p. 140.

The author illustrates the following Trilobites:

Homalonotus noticus Clarke, *H. (Schizopyge) parana* Clarke, *H. herscheli* Murch. *Dalmanites acacia* Schwarz.

Calmonia new genus, *C. ocellus* Lake, *C. subseciva* Clarke, *C. signifer* and variation, *micrischia* Clarke. Proboloides new genus, *P. cuspidatus* Clarke and *P. pessulus* Clarke.

Pennaia new genus, *P. pauliana* Clarke. *Cryphaeus allardyceae* Clarke, *C. australis* Clarke. *Dalmanites falklandicus* Clarke, *D. accola* Clarke. *Homalonotus perceensis* Clarke.

——— Fosseis Devonianos do Paranä.

Service Geol. E. Mineralogico do Brazil, vol. 1, 1913.

The author illustrates and describes the following Trilobites:

Homalonotus noticus nov. (a Falkland Island species), *H. Herscheli* Murchison, *H. (Schzopyge) parana* nov. *Dalmanites accola* nov., *D. Falklandicus* nov., D. sp. *Cryphaeus australis* nov., *C. allardyceae* nov., C. sp.

Group Mesembria—*Dalmanites acacia* Schwartz.

This is the *Phacops crista galli* Lake, 1904, which Schwartz Record, Albany Mus., 1906, refers to *Phacops acacia. Dalmanites africanus* (Salter) Lake.

Calmonia gen. nov. type, *C. signifer* nov.

In 1889 Oehlert introduced the name of Cryphina as a generic name for a Devonic species for a triangular, highly convex dalmanitid pygidium, having a series of five or more broad, closely appressed small spines on each side. Similar forms described for

CLARKE (J. M.)—Continued.

New York Devonic as *Dalmanites concinna* var. *serrula* in 1888, and referred to *Cryphina serulla.*

The author in view of the known variation between Cryphaeus and Hausmannia places the new genus with a caudal extension in his new genus. The head differs from that of Cryphaeus. The author describes in addition to the type *Calmonia signifer* var. *micrischia* nov., *C. subseciva* nov. and *C. ocellus* Lake, described by Lake under the genus Phacops from South Africa. *C. ? gonzana* Clarke.

Pennaia new genus type, *P. pauliana* nov.

A very distinct variation of the Mesembria type of Dalmanites is expressed by *Pennaia pauliana.* In general aspect it is distinctly more Phacopidean than Calmonia, in respect: first, to the head, in which all parts are more compact and condensed; second, in the thorax, where the axis is relatively much broader than the side lobes, while the ends of the anterior segments are rounded rather than lanceolate; third, in the pygidium, which is phacopidean in its small size and sparse segmentation. The margin of the pygidium is fimbriate, bearing three flattened spinules on each side.

Proboloides gen. nov. type. *P. cuspidatus* and *P. pessulus* nov.

In the possession of a frontal snout on the head this species is a Probolium after the type of snouted Dalmanitids, but in respect to the character of the snout, the form of the cephalon, its style of lobation and smoothness of surface, it departs from the type and is an expression of the Mesembria structure.

The author proposed the term Phacopina in place of Phacopidella, which Reed uses for Acaste, a preoccupied term.

——— and **Swartz** (Charles K.) Trilobita.

Geol. Sur. Maryland Upper Devonia, Baltimore, 1913, p. 699.

Phacops rana Green, 1832.

——— Report of Director, 1913.

New York State Mus. Bull. 173, 1914.

Restoration of *Pterygotus buffaloensis,* also of Eusacus and that of *Stylonurus excelsior.*

Cleland (Herdman F.) Further notes on the Caleiferous (Beekmantown) formation of the Mohawk Valley, with descriptions of new species.

Bull. Am. Palæontology IV, No. 18, 1903, pp. 37-50, plates.

Bathyurus ellipticus nov. sp. *Harrisia parabola* nov. sp.

Crossmann Rev. Crit. Palæont., replaces the preoccupied named of Harrisia to that of Clelandia.

———The fossils and stratigraphy of the Middle Devonic of Wisconsin.

Wisconsin Geol. and Nat. Hist. Sur. Bull. 21, 1911. Chapter X, Crustacea.

The Middle Devonic formation in Wisconsin has yielded very few crustacean remains. The most widespread trilobite is *Phacops rana.*

The author describes and illustrates *Proetus Rowi* Green. *Phacops rana* Green. *Proetus crassimarginatus* Hall.

Ostracoda: *Bollia ungula* Jones. *Barychilina walcotti* Jones. *Kirkbya subquadrata* Ulrich. *Ulrichia conradi* Jones.

Phillopocarida: *Echinocaris punctata* Hall, and Tropidocaris sp.?

——— A study of the fauna of the Hamilton formation of Cayuga Lake section in central New York.

Bull. U. S. Geol. Sur., No. 206, 1903, 112 pp., 5 plates.

The author gives a list of Crustacea on pp. 79-81, with notes on their occurrence.

Cobbold (E. S.) On some small Trilobites from the Cambrian Rocks of Comley, Shropshire.

Quart. Jour. Geol. Soc., vol. 66, No. 261, pp. 19-50, plates 3-8.

Microdiscus comleyensis n. sp.

This species appears to be somewhat intermediate between *M. speciosus* Ford and *M. punctatus* Salter, but only has 7 annulations in the axis of the pygidium.

Microdiscus lobatus Hall, *M. Helena* Walcott, *M. speciosus* Ford. *Ptychoparia ? Attleboroughensis* Sh. and F., *P.? annio* n. sp. *Micmacca ? ellipsocephaloides* n. sp. cf., *M. recurva* Matthew. *M. ellipsocephaloides* var. Spinora and var. *strenuelloides* and var. *senior*, *M. ? parvula* n. sp. *Agraulos (Strenuella) salopiensis* n. sp. *Anomacare platycephalum* n. sp., *A. parvum* n. sp., *A. ? pustulatum* n. sp. *Protolenus latouchei* n. sp., *P. morpheus* n. sp. *Mohicana* n. gen.

This new genus has characters very similar to those of *Micmacca ? plana* Matthew, which that author referred provisionally to his genus.

Mohicana lata n. sp., *M. clavata* n. sp.

The author remarks these two species have many points of resemblance with *Micmacca ? plana* Matthew, also with *Avalonia manuelensis* Walcott; but the peculiar groove on the line of the ocular ridge are absent, and the frontal limb is more extended.

——— Report of the Geological Excavation Committee of the British Association, read at the Dublin Meeting, 1908.

Rep. Brit. Assoc., 1908, Dublin, 1909, pp. 241-42.

Microdiscus sp. *Anomocare* cf. *Agraulos strenuus* var. *nasutus* Walc. *Anomocare* sp. 1 and 2, also 3, *Anomocare* vel. *Agraulos* sp. *Protolenus* sp.

— —— Trilobites from the Paradoxides beds of Comley, Shropshire.

Quart. Jour. Geol. Soc. London, vol. 67, No. 267, 1911, pp. 282-311, plates 23-26.

The author describes *Paradoxides Groomi* Lapworth from the type specimen, and figures it for the first time; also *Paradoxides* sp. indet., *P. Davidis* Salter, *P. rugulosus* Corda. *Conocoryphe emarginata* Linnarsson var. *longifrons* nov. *Dorypyge Lakei* sp. nov. This species is nearly allied to the pygidae of *Dorypyge oriens* Grönwall.

The species might be compared with *Dikellocephalus Marcoui* (Whitfield) from Georgia, Vermont; see, also, Walcott's figures of this species.

Agnostus fallax Linnarsson, *Microdiscus* sp. cf., *M. punctatus* Salter. *Agraulos holocephalus* Matth., *A.* sp. cf., *A. quadrangularis* Whitf.

The author follows Reed's classification of the genus *Ptychoparia* Corda, and places the genera *Ptychoparia Liostracus* and *Conocephalites*, under subgenera to *Ptychoparia*.

The author describes *Ptychoparia (Liostracus) pulchella* sp. nov., nearly related to *Liostracus validus* Matth. and *L. Linnarssoni* Brögger, but differ from both in the relative length of the glabella. *Ptychoparia (Liostracus)* sp. ident. two forms and *P. (Liostracus) dubia* sp. nov.

——— The Trilobite fauna of the Comley Breccia-Bed, Shropshire.

Quart. Jour. Geol. Soc., vol. 59, No. 273, pp. 27-50, plates 2 and 3.

The author describes and illustrates *Paradoxides intermedius* nov.

The species differs but slightly from *P. Hicksii*, its var. *palpebrosus* Linnarsson and *P. Sjögreni* in the course of the facial suture and general form.

Agraulos sp. cf., *A. Quadrangularis* Whitfield. Subgenus *Strenuella (Agraulos)* sp. indet. *Conocoryphe aequalis* Linnrs., *C. bufo* Hicks. subgenus *Liocephalus impressa* Linnrs. *Dorypyge reticulata* nov.

The cranidia of *D. Lakei* is very much like the new species, but the thorax and pygidia are different, and the reticulate character of the test very distinctive.

Microdiscus punctatus Salter. *Ptychoparia (Liostracus) lata* nov.

The species is related to *P. valida* Matthew and *P. Linnarssoni* Brögger. *Ptychoparia (Liostracus)dubia* Cobbold.

Cole (A. J.) On *Belinurus kiltorkensis* Bailey.

Geol. Mag., Decade 4, vol. 4, 1901, pp. 52-54, figures.

Collie (George). Lower Ordovician section, near Bellefront.

Bull. Geol. Soc. Am., vol. 14, 1903, pp. 407-420, plate 59.

Brongniartia Trentonensis Simpson.

The generic name of Brongniartia was used as a subgenus to Homalonotus by Salter in 1865; also by Green Mong. Tril., 1832, for a species of Homalonotus; and by Eaton, Am. Jour. Sci., vol. 22, 1832, p. 165, for what is now known as *Triarthrus Beckii* Green.

The author also describes *Encrinurus tuberculosis* nov. sp.

Crosfield and Skeat. On the Geology of the neighborhood of Carmathen.

Quart. Jour. Geol. Soc. London, vol. 52, 1896, p. 523.

Peltura punctata nov. sp. *Parabolinella* sp. and *Ogygia marginata* nov. sp.

Crossman (M.) Revue Critique Paléontologie. 1902, sixieme Ann., p. 52.

Redlichia nov. gen.

The author uses this term to replace Haeferia, Redlich, Tril., 1899, non Bittner Moll., 1895.

Cumings (E. R.) The Stratigraphy and Palæontology of the Cincinnati series in Indiana.

32 Ann. Report Geol. and Natural Resources of Indiana, 1908, pp. 605, 1188, 55 plates. The Ostracoda and Trilobites are figured on pls. 53-55.

Ostracoda: *Bollia pumila* Ulrich. *Ceratopsis Chambersi* Miller and var. *robusta* Ulrich, *C. oculifera* Hall. *Ctenobolina ciliata* var. *Hammeli* M. & F. *Entomis Madisonensis* Ulrich, *Eurychilina striatonarginata* Miller. *Leperditia caecigena* Miller. *Primitia cincinnatiensis* Miller, *P. impressa* Ulrich. *Tetradella quadrilirata* H. & W., also var. *simplex* Ulrich. *Lepidoleus Jamesi* H. & W.

Trilobites: *Acidaspis ceralepta* Anthony, *A. cincinnatiensis* Meek, *A. crosotus* Locke. *Calymmene calicephala* Green. *Ceraurus pleurexanthemus* Green, *C. icarus* Billings. *Dalmanites breviceps* Hall. *Isotelus maximus* Locke. *Proetus spurlocki* Meek. *Trinucleus concentricus* Eaton.

Referred to *Cryptolithus tessellatus* Foerste, Bull. Sci. Denison Univ., 1910, vol. X, p. 78.

Dahmer (G.) Ein Hautungsplatz von Homalontus gigas A. Roemer im linksrheinischen Unterdevon.

Jahrb. des nass. Vereins für Naturkunde 67, 1914, plates 2 and 3.

Homalonotus gigas.

Delgado (J. F. N.) Fauna Cambrienne du Haut Alemtejo.

Geol. du Portugal, vol. V, 1904, 6 plates.

In the description of fossils, p. 318, the author describes *Paradoxides Choffati* nov.; also P. aff. *abenacus* Matth. var., ? P. aff. *spinosus* Boeck, *P. costae nov.* and *P.* aff. *Tessini* Brong. Olenopsis sp. Hypostoma of Olenollus?

The new genus Hicksia, founded on a group of species resembling Conocoryphe humerosa Salter.

It has the tumid cheek and galbella of Solenopleura, with the smooth test of Liostracus, but the glabella narrows in rear and the pygidium is smaller.

He includes 9 new species under the genus: *Hicksia elvensis, H. sphaerica, H. Transtanensis, H. Walcotti, H. Castroi, H. Hughesi, H. Barroisi, H. Dewalquei* and *H.* minuta.

Metadoxides Bornemanni, Olenellus ? Macphersoni nov. *Microdiscus caudatus* nov., *M. subcaudatus* nov., *M. Wenceslasi* nov., *M. Souzai* nov. and *M. Woodwardi* nov.

I would suggest the generic name of Delgadoia for these species, with eyes and three thorax segments, also with caudal spines.

Drevermann (Fritz). Die Fauna der oberdevonischen Tuffbreccie von Langenaubach bie Haiger.

Jarhrbuch d. K. preuss Geol. Landesanstalt für, 1900, pp. 99-207, 9 plates.

The author describes and illustrates:

Phacops cryptophthalmus Emm., *P. granulaus* Münster, *P. caecus* Gurich, *P. sulcatus* nov., *P. brevissimus* nov., P. cf. *mastophthalmus* Richter, *P. (Trimerocephalus) anophthalmus* Frech, *P. (T.) Lotzi* nov., *P. (Trim.) miserrimus* nov. *Proctus carintiacus* nov., *P. dillensis* nov. *Dechenella* sp. ? *Bronteus* cf. *granulatus* Goldf.

——— Ueber eine Vertretung der Etroeungt-Stufe auf der rechten Rheinseite.

Zeitschr. d. Deutsch Geol. Ges. 54, pp. 480-524, pl. 14, 1904.

Brachymetopus sp. and Phillipsia sp.?

Diener (Carl). The Permocarboniferous Fauna of Chitichun, No. 1.

Memoirs Geol. Sur. of India, Palæontologia Indica, Ser. xv, vol. 1, pt. 3, 1897, p. 105, plate 13.

Cheiropyge nov. gen., *C. Himalayensis* nov. sp.

The genus was proposed for certain Trilobites from the Carboniferous or Permian rocks in which the 6 pleural ridges and 15 axial rings of the pygidium extended beyond the border, such as *Philippsia lodiensis* Meek and *Dalmanites Cuyahogae* Claypole.

A similar fossil to Cheiropyge was made into a new genus by Girty under the term of Anitopyge.

This author does not compare *Phaethonides spinosus* Herrick, Bull. Denison Univ., vol. 4, pl. 1, fig. 4, with 14 axial lobes and 9 pleurae.

The author also describes *Phillipsia Middlemissi* nov. sp., which the author compares with certain British Trilobites such as *P. Cliffordi*, etc.

Diener (Carl). Anthracolithic Fossils of Kashmir and Spiti.

Memoirs Geol. Sur. India, Palæontologia Indica, Ser. xv, vol. 1, pt. 2, 1899.

Phillipsia sp. ind. aff. *seminifera* Phillips.

This species which was figured by Lydekker, Mem. Geol. Sur. of India, vol. 22, pl. 2, figs. 5, 5a, may be congeneric with the European species, but the state of preservation of the latter is too indifferent to warrant an exact determination. An Australian species, *Griffithides dubius* Etheridge, is closely allied to the present one.

Dowling (D. B.) Report on a Survey of the Ekwan River and of the Route through Sutton Mill Lake Northward.

Geol. Sur. Canada, Ann. Report, n. ser., vol. 14, 1901, F.

Crustacea, p. 57 F: *Calymene Niagarensis* Hall, Illaenus sp. *Bronteus Ekwanensis* nov. sp., *B. aquilonaris* nov. sp., *B. Niagarensis* Hall. *Ceraurus Tarquinis* Billings.

The Appendix I to this paper was edited by J. F. Whiteaves, pp. 38-60, therefore the new species of Bronteus described from the pygidia should be credited to Whiteaves.

Dufet (Henri). Notes sur les déformation des fossiles contenus dans les roches schisteuses et sur la détermenative de quelque especes du genre Ogygia.

Ann. de L'ecole Normale supérieure, 1875, pp. 183-190, 2 figures.

Ogygia Edwardsi Rouault, *O. Brongniarti* Rouault, *O. Guetardi* Rouault, *O. Delesii* nov. sp. figures the pygidium.

The new species has 5 axial rings, 8 side ribs and a pointed tail.

Eastman (Charles R.) Text book of Palæontology, adopted from the German of Karl A. von Zittel.

Second edition, vol. 1, 1913, 839 pp., 1594 figures.

Edgell-Wyatt (H. A.) On a new Lichas and other new forms from the Llandelio Flags.

Geol. Mag., Decade 1, vol. 3, 1866, pp. 160-163.

Lichas partriarchus nov. sp.

Most of the Swedish Lichadæ are distinguished from it by the incompleteness of the first pair of glabella furrows.

Ellis (G. L.) and **Salter** (I. I.) The highest Silurian rocks of the Ludlow Dist.

Quart. Jour. Geol. Soc. London, vol. 62, 1906, pp.*195-227, Geol. Map.

List of Ludlow fossils.

Etheridge (Robert, Jr.) The largest Australian Trilobite discovered.

Proc. Roy. Soc. Victoria, vol. 6, 1894, new ser., pp. 187-194, plate.

Bronteus enornis nov. sp.

——— Evidence of the existence of the Cambrian fauna in Victoria.

Roy. Soc. Victoria, 1895, pp. 52-64, plate.

Dinesus Ida n. gen. et sp.

The glabella has pyriform basal lobes; the bifurcating grooves near the anterior portion outline triangular lobes, on each side of the glabella. Pygidium ending in 5 or 6 short spines.

——— Official Contributions to the Palæontology of South Australia, No. 9.

On the occurrence of Olenellus in the Northern Territory.

South Austr. Parl. Papers, 1897, No. 1353, pp. 13-16, plate 1, fig. 1.

The author describes *Olenellus Brownii* n. sp., which agrees with the Swedish *O. Kjerulfi* Linnrs. He doubts the presence of facial sutures in the genus.

Peach lays great stress on the non-detection of the facial suture in Olenellus as proving that the Olenelli had no free cheek, and should therefore be separated from the Trilobita.

Quart. Jour. Geol. Soc., vol. 48, 1892, p. 242.

——— Additions to the Cambrian fauna of South Australia.

Trans. Roy. Soc. S. Australia, vol. 29, pp. 246-251, 1905.

Olenellus sp.

ETHERIDGE (Robert, Jr.)—Continued

——— A further Cambrian Trilobite from York Peninsula.

Trans. Roy. Soc. S. Australia, vol. 22, 1898, pt. 3, plate IV.

Ptychoparia Howchini n. sp.

Woodward in 1884 described two Cambrian Trilobites from the Yorke Peninsula as *Dolichometopus Tatei* and *Conocephalites australis*. Tate has also described from the same District *Olenellus Prichardi* and *Microdiscus subsagittatus*, in Trans. R. Soc. S. Austr., 1892, XV, pl. 2, p. 187.

——— Additional Notes on the Palæontology of Queensland. Part 1, Palæozoic.

Proc. Linn. Soc. New South Wales, vol. 9, 1894, p. 528, pl. 39, fig. 3.

Griffithides Sweeti Eth. fil. MS.

This is an abnormal form departing both from Phillipsia and Griffithides in possessing 10 instead of 9 thoracic segments, and in the presence of the supplementary basal lobes on the glabella. The supplementary lobe to the glabella is present in some Proeti, such as *Proetus bohemicus* Corda. Burmeister has classed such species under Æonia, but McCoy's Forbesia had anticipated him by a few months.

——— The Trilobite Illaenus in the Silurian rocks of New South Wales.

Records Geol. Sur. N. S. Wales, vol. 8, p. 319, figs. 1-2.

Illaenus Johnstoni Eth. fil.

The original description. Tasmania Report Sec. for Mines for 1895-96, pl. fig. 3, page XLIII.

Two species of Illaenus have been recorded from the Silurian rocks of Australia. DeKoninck refers one to *Illaenus Wahlenbergianus* Barr., and the other from Tasmania was referred to this new species.

——— Trilobite remains collected on the Florentine Valley, West Tasmania, by Mr. T. Stephens.

Records of the Austr. Mus., vol. 5, part 2, 1904.

The author describes and figures the pygidium of Niobe sp. ind.; also that of *Dicelocephalus Florentinensis* Eth. fil., plate 10, figs. Walcott refers this to the genus Dikelokephalina Brögger.

——— Additions to the Cambrian fauna of South Australia.

Trans. and Proc. Roy. Soc. of South Australia, vol. 29, 1905, pp. 246-251.

The Olenellus described, p. 247, pl. 25, fig. 1, is referred by Walcott Cambrian fauna of China to the genus Redlichia.

——— The existence of a Cambrian fauna in Victoria.

Proc. Roy. Soc. of Victoria, for 1895, new ser., vol. 8, 1896, pp. 52-64.

——— and Mitchell (John). The Silurian Trilobites of New South Wales, with reference to those of other parts of Australia, Part 4.

The Odontopleuridae.

The authors use the term Odontopleuridae in preference to Acidaspidae, because they believe it to have precedence. Burmeister used the term in 1843 (Organization of Trilobites) for eight-jointed Trilobites with a short articulated caudal axis, incapable of enrollment. Division B, Subdivision A.

Proc. Linnean Soc. New South Wales, vol. 21, 1897, pp. 694-721, 6 plates.

ETHERIDGE (Robert, Jr.) and MITCHELL (John)—Continued

The authors describe:

Odontopleura Bowningensis n. sp., *O. Rattei* n. sp., *O. parvissina* n. sp., *O. Jenkinsi* n. sp., (The *Acidaspis Brightii* Jenkins mon. Murchison). *Ceratocephala Vogdesi* n. sp. (*Acidaspis Verneuili* Ratte non. Barrande), *C. Jackii* n. sp., *C. impedita* n. sp., *C. longispina* Mitchell.

——— The Silurian Trilobites of New South Wales with references to those of other parts of Australia.

Proceedings Linn. Soc. N. S. Wales, 1915, vol. 40, part 4, 1916.

Part V, The Encrinuridae, plates 54-57, pp. 646-680.

The authors describe and illustrate the following species:

Encrinurus Mitchelli Foerste, referring *Cromus Murchisoni* DeKoninck, pl. 1, fig. 9 (exclude figs. 9a and 9b) to the species.

Encrinurus Bowningensis Foerste.

The following are described as new species:

Encrinurus silverdalensis, a robust species, about 2 inches long; the head approaches *E. variolarlis*, but its enormous tail separates it from the European species.

Encrinurus Etheridgei, the largest Australian form known, has a length of 2½ inches, of which the tail occupies one inch.

Encrinurus Rothwellae.

The subrectangular and steep-sided thorax, very prominent thorax and pygidial axis, a circular end of the tail—axis, 11 pleural segments in the pygidium, widely expanded and tumid glabella, anteriorly forward eye-lobes, and strong drooping of the pygidium posteriorly, separate this species from *E. Mitchelli.*

Encrinurus ? duntroonensis.

The authors illustrate only the head, which differs from all other species referred to Encrinurus.

1. In the transversely elongated elliptical form of the cephalon, with its nearly straight anterior border.
2. The closeness of the anterior branches of the facial sutures and the perpendicularity of the posterior branches of these, with the axial furrows, or central axial line.
3. The long, narrow and straight-sided glabella.
4. The anteriorly situated free cheek.
5. The sparse tuberlation.
6. The backward and inward situation of the eyes.
7. The manner in which the axial furrows bifurcate outward and inward on reaching the frontal borders of the free cheeks.

The authors suggest a new genus without naming it. Why not that of *Mitchellia* after this well-known author on the fossil Crustacea.

Fearnsides (W. G.), Elles (G. L.) and Smith (Bernard). The Lower Palæozoic Rocks of Pomeroy.

Proc. Royal Irish Acad., vol. 26, sec. B, No. 9, 1907, pp. 97-128, map and plate.

Trilobites: *Trinucleus concentricus* Eaton; also var. *Portlockii* Salter and var. *elongatus Portl.* and var. *arcuatus.*

Trinucleus seticornis His. *Dionide* cfr. *euglyptus* Ang. *Æglina rediviva* Barr. *Phacops mucronatus* Brong.

The other Trilobites collected from Pomeroy have been described by Portlock in his Londonderry report.

Field (R. M.) Use of the Roentgen Ray in Palæontology Skiagraphy of Fossils.

Am. Jour. Sci., vol. 39, 1915, p. 543.

The author illustrates *Triarthrus Becki* in text and plate 8, fig. 9. The figure brings out the outline of the trilobite and several appendages which are buried in the matrix.

Finch (Grant E.) Notes on the position of the individuals in a group of *Nileus vigilans* found at Elgin, Iowa.

Iowa Acad. Sci. Proc., vol. 11, pp. 179-181, plate, 1904.

Foerste (A. F.) Notes on Clinton Group Fossils, with special reference to collection from Indiana, Tennessee and Georgia.

Proc. Boston Soc. Nat. Hist., vol. 24, 1889, p. 261.

The author notes *Calymmene Blumenbachii* var. *Vogdesi* n. var., *C. rostrata* Vogdes.

Dr. Ulrich describes from the Niagara formation at Osgood, Ind., under the name of *Calymmene nasuta* n. sp., a snouted trilobite of a very large size, which resembles *Calymmene Niagarensis* Hall. This specimen was published in the Jour. Cincinnati Soc. Nat. Hist., vol. 2, No. 3, October, 1879, p. 131, figs. 1, 2 and 3. The Harvard Library did not receive this number until Feb. 19th, 1880, or about the time of its probable publication. About this time, in the Amer. Jour. Sci. for December, 1879, a species was described by Vogdes as *Calymmene rostrata* from the Clinton Group of Georgia Catoosa Station. These forms are very closely related to New York specimens, which are not quite so large, and the end of the snout is not so pointed as the published figures would indicate.

Dr. Berjoron, Bull. Soc. Geol. de France, 3d ser., vol. xviii, 1890, p. 365, pl. v, places similar species under a new genus. Describing under it *Calymmenella Boisseli* n. sp. and n. genus. The glabella is short and rounded in front, having three furrows, of which the last two are well marked. The specimen is somewhat like *Calymmene mammillata* Hall, from the Niagara group in Wisconsin.

The author also notes *Illaenus ambiguus* Foerste, *I. ioxus* Hall. *Phacops pulchellus* Foerste. *Encrinurus punctatus* Wahl. *Lichas Boltoni* var. *occidentalis* ? Hall and *Cyphaspis clintoni* n. sp.

The author, on p. 272, places *Encrinurus ornatus* Hall with *E. Theschi* Foerste. He was in doubt regarding the Ohio specimen referred by Hall and Whitfield to *E. ornatus*, on account of its larger size and its higher geological position.

——— A description of the Trilobites, Mollusks and Brachiopods of the Clinton Group of Ohio and Indiana.

Geology of Ohio, vol. vii, 1893, pp. 522-601, plates 25-37a.

The author notes *Acidaspis Ortoni* Foerste, *A. brevispinosa* n. sp. *Proetus determinatus* Foerste. *Cyphaspis clintonensis* Foerste. *Illaenus daytonensis* H. and W., *I. ambiguus* Foerste, *I. insignis* Hall, *I. madisonensis* Whitf. *Calymmene Vogdesi* Foerste. *Ceraurus (Pseudosphaerxochus) clintoni* n. sp. *Sphaerexochus pisum* n. sp. *Lichas breviceps* Hall. *Phacops trisulcatus* Hall. *Dalmanites Wertheri. Encrinurus punctatus* Wald. *Elpe Ulrichi* n. sp.

——— Characteristic Silurian Fossils from East Central Kentucky.

Geol. Sur. Kentucky Bulletin, No. 7, 1906, Part 3.

The author describes *Isochilina panolensis, Beyrichia lata-triplicata.* He also remarks that Prof. Hall, in Palæontology of New York, vol. 2, p. 301, published descriptions of a species of Bollia and of a species of Beyrichia under the same name *Beyrichia lata,* erroneously regarding these distinct species as opposite valves of the same species. Beyrichia is described first, but on Plate A 66 the Bollia is figured first.

The author refers to *Bollia lata* Hall's fig. 10b, and to *Beyrichia lata* Hall's figs. 10, c, d, e, pl. A 66.

FOERSTE (A. F.)—Continued

——— Silurian Fossils from the Kokomo West Union and Alger horizons of Indiana, Ohio and Kentucky.

Jour. Cincinnati Soc., vol. xxi, No. 1, 1909.

The author describes and illustrates *Isochilina panolensis* Foerste, *I. musculosa* n. sp. *Beyrichia lata—triplicata* Foerste. *Kloedenia kokomoensis* n. sp. *Illaenus depressus* Foerste. *Calymmene Clintoni* Vanuxem, *C. niagarensis* Hall. *Homolanotus delpinocephalus* Green. *Dalmanites tirulurus brevicaudus* var. nov.

——— Preliminary note on Cincinnatian Fossils.

Bull. Denison Univ., June, 1909, vol. 14.

The author describes *Ceraurus miseneri* nov. sp. from Richmond, Ind.

—— Preliminary note on Cincinnatian and Lexington Fossils of Ohio, Indiana, Kentucky and Tennessee.

Bull. Denison University, June, 1910

The author favors the use of Cryptolithus Green, for the genus Trinucleus, a generic term used by Bronn, Goldfuss, Emmrich, Angelin and Vogdes; although the generic name of Nuttainia was used by Eaton in 1832, in his Geological Text Book, 1832, p. 33, for a similar species to *Trinucleus tessellatus* Green.

The original description of this genus by Green, The Monthly American Journal of Geology, June, 1832, p. 560, pl. fig. 4, is as follows:

Genus Cryptolithus, *C. Tessellatus Green*, fig. 4.

"Clypeo rotundato, fronte valde convexo, capite antice semicirculari, margine tessellato, ornato."

Green Mon. Trilobites, p. 88, remarks Cryptolithus was proposed before the publication of Nuttainia Eaton.

Rafinesque in his paper dated Philadelphia, May, 1832, Atlantic Journal and Friend to Knowledge, vol. 1, No. 2, 1832, article on "The Genera of fossil Trilobites or Glomerites of N. America," mentioned Cryptolithes Green, on p. 72, and remarks that Dr. Green issued in April a first series of eight cast and species, accompanied with a synoptical table, among which a new genus Dipleura, and four new species of Asaphus and Calymmene.

Vogdes, in Bib. Palæozoic Crustacea, 1893, p. 359, remarks that Trinucleus Lhwyd, 1698, Lithophyacii Brittannici Ichnographia, Epistola 1, also Murchison Silurian System, 1839, p. 659, was a revived old name. Dr. Lhwyd's description meant no more than the general name of Trilobite of the more modern writers and could not, except by courtesy, set aside Dr. Jacob Green's gen. *Cryptolithus*. This generic name has been advocated by Foerste, also by Raymond, in a later publication.

The author also describes *Calymmene platycephala* sp. nov., *C. senaria* Conrad, *C. abbreviata* sp. nov., *C. callicephala* Green, *C. Meeki* sp. nov., *C. Meeki—retrorsa* and *Dalmanites Carleyi—rogersensis*.

Calymmene Meeki Foerste, Bull. Denison Univ., vol. 16, 1910, p. 84, pl. 3, fig. 18. This is the Calymmene senaria described by Meek from the Cincinnati Rocks. As types the larger specimens from Fairmont bed are selected. They have a rather extended posterior outline of the cephalon, resulting in acute genal angles.

Frech (Fritz). Die Karnischen Alpen, 1894.

The author refers *Phacops (Trimerocephalus) cryptophthalmus* (Emm.) Trestze to the new species of *anophthalmus*.

—— Palæozoica, 1897, Bd. 2, Theil 1.

The author describes as new *Phacops (Trimerocephalus) anophthalmus*, p. 278, plate 35, fig. 18.

——— Lethæa geognostica, part 1, Lethæa palæozoica, Bd. 2, p. 66, 1902.

The author proposes the genus Proampyx for *Anomocare acuminatum* Angelin. This species, with its pointed glabella, seems to be the forerunner of Ampyx, and differs from the typical Anomocare with rounded, cephalic shield, very greatly.

Fritsch (Dr. Ant.) Preliminary notes on *Prolimulus Woodwardi* from the Permian Gaskohle als Nyran Bohemia.

Geol. Mag. London, Decade iv, vol. 6, 1899, pp. 57-59.

The author gives a figure of *Prolimulus Woodwardi* on p. 58, and remarks that Prolimulus very closely resembles one of the embryonic stages of the living North American *Limulus polyphaemus*. The earliest known Limuloid Crustacean named *Neolimulus falcatus*, Woodward Geol. Mag., vol. 5, p. 1, pl. 1, figs. 1, 1a, 1868, was from the Silurian of Lesmahagow, Scotland. Bailey described *Bellinurus Kiltorkensis* from the Upper Old Red Sandstone Kiltorcan, Ireland, in 1869.

The genus Bellinurus was established by Konig in 1825, for certain small king crabs, under the specific name of *B. bellulus*, without a description of the genus or species. It is now known as *Bellinurus lumatus* Martin Petrefacata Derbiensia, pl. 45, fig. 4.

Bailey in 1863 described *B. arcuatus* and *B. reginae*, from the Coal Measures of Queens County, Ireland. In 1872 Woodward described *B. Koenigianus* Coal Measures, Dudley.

Meek and Worthen from the Coal Measures of Illinois, describes *Prestwichia (Limulus) anthrax* Prest. and *P. rotundata* Prest.

In 1872 Woodward described *P. Birtwelli* from Coal Measures, Padiham, Lancashire.

These Crustaceans have been described from the Muschelkalk, Jurassic, Cretaceous and Tertiaries, and are now living in the seas of Eastern North America and of Japan. A remarkable persistent type of the Xiphosura from the Silurian to the present time.

Frood (A. H.) Description of fossils from Kimberley District, Western Australia.

Geol. Mag. London, Decade 3, 1890, vol. 7, p. 98.

Olenellus ? Forresti n. sp., pl. 4, figs. 2 a-b.

Walcott, 1913, p. 104, refers this to the genus Redlichia.

Gaudry (A.) Les enchainements du monde animal dans les temps Géologiques Fossils Primaires, Chapter X, 1877.

The author illustrates many species of Palæozoic Crustacea with figures of *Asaphus platycephalus* and *Calymmene senaria* exhibiting the ventral side and structure of the feet and antennae.

Geinitz (H. B.) Die Versteinerungen der Steinkohlen formation in Sachsen, Leipzig, 1855.

The author describes as *Halonia irregularis* several fragments of Arthropleura, p. 38, pl. 4, fig. 5.

Gemmellaro (G. G.) Crostacei dei calcari con fusulina della Valle del fiume sosio nella Prov. di Palermo in Sicilia.

Mem. Soc. Ital. Sci., vol. 8, 1890, 3d ser., 40 pp., with 5 plates.

Trilobiti—*Proetus postcarbonarius*, n. sp., *P. ? Salomonensis* n. sp. *Phillipsia sicula* n. sp., *P. Oehlerti* n. sp., *P. Sosiensis* n. sp., *P. pulchella* n. sp. *Griffithides verrucosus* n. sp. *Pseudophillipsia elegans* n. gen. et sp.

The type of the new genus is *Pseudophillipsia Sumatrensis* Roemer.

Macruros Crustaceans—*Palaeopemphix* n. gen., *P. Sosiensis* n. sp., *P. affinis* n. sp., *P. Meyeri* n. sp.

Brachyurous Crustaceans—*Paraprosopon* n. gen., *P. Reussi* n. sp. *Oonocarcinus* n. gen., *O. insignis* n. sp., *O. anceps* n. sp., *O. Geintzi.*

Ostracoda—*Cypridinella rostrata* n. sp., *C. inflata* n. sp., *C. cypridellopsis* n. sp., *Cypridella Jonesi* n. sp., *C. granulifora* n. sp. *Cypridina Adrianensis* n. sp., *C. elliptica* n. sp., *C. marginata* n. sp., C. aff., *C. primaevae* McCoy. *Philomedes acanthoides* n. sp. *Entomoconchus elongatus* n. sp. *Entomis polita* n. sp., *E. aequilobatus* n. sp. *Beyrichia* sp.?

Girty (George H.) Devonian and Carboniferous Fossils.

U. S. Geol. Survey, Monograph No. 32, 1899; part 2, pp. 476-581.

Proetus peroccidens H. and W., *P. Loganensis* H. and W.

The author is inclined to include both of these species under one, but leaves it an open question.

——— Notes on the Carboniferous Fossils, Geology and ore deposits Bisbee Quadrangle, Arizona.

U. S. Geol. Survey, Professional Papers No. 21, 1904, pp. 46-53, 2 plates.

Phillipsia peroccidens H. and W. figured the pygidium, pl. X, fig. 22. The species is rather characteristic of the Escabrosa Limestone.

——— The Guadalupian fauna.

Professional Paper U. S. Geol. Sur., No. 58, Washington, 1908.

The author uses *Anitopyge* new genus for *Phillipsia peranulata* Shumard.

The genus Phillipsia has 9 thoracic segments, and the new genus, as far as known, has but 7. In the pygidium the axis contains about 30 joints.

Anitopyge is similar to *Cheiropyge* (a new genus described by Diener of Himalayan fossils) in the unequal segmentation of the axial and lateral portions of the pygidium—in Anisopyge the pygidium is surrounded by a broad, smooth band, while in Cheiropyge the lobes are extended so as to give this member a denticulate outline.

The author describes *Anisopyge antiqua* n. sp. *Cythere* ? sp. *Bairdia* aff., *B. plebeia* Ruess, *Argilloecia* sp.

——— The fauna of the phosphate beds of the Park City formation in Idaho, Wyoming and Utah.

Bull. U. S. Geol. Sur., No. 436, Washington, 1910.

The author describes and figures *Hollina emaciata* var. *occidentalis* n. var. *Jonesiana carbonifera* n. sp., which closely resembles the English species *J. arcuta,* but differs in a more equilateral form with a much narrower sulcus.

Cytherella benniei J. and B.

——— The fauna of the Moorefield shale of Arkansas.

Bull. U. S. Geol. Sur. No. 439, 1911.

The author records an undetermined Griffithides and three Ostracoda. *Paraparchites nicklesi* Ulrich, *Primitia moorefieldana* n. sp. and *Bairdia attenuata* Girty.

——— On some new genera and species of Pennsylvania fossils, from the Wewoka formation of Oklahoma.

Ann. N. Y. Acad. Sci., vol. 21, pp. 119-156, 1911.

Describes *Griffithides parvulus* n. sp. Differs from *G. ornatus* in the configuration of the basal portion of the glabella.

GIRTY (George H.)—Continued

——— A report on the upper Palæozoic fossils collected in China in 1903-04.

Carnegie Inst. Washington, Research in China, vol. 3, 1913, pp. 297-328, pls. 27-29.

The author illustrates an imperfect pygidium of Phillipsia, somewhat like *P. scitula* of the American Coal Measures.

——— New genera and species of Carboniferous fossils from the Fayetteville shales of Arkansas.

Annals New York Acad. Sci., vol. 21, 1910, pp. 189-238

Griffithides parvulus nov., *G. mucronatus* nov.

——— Fauna of the Wewoka formation of Oklahoma.

Bull. U. S. Geol. Sur., No. 544, 1915.

The author refers *Phillipsia (Griffithides ?) Sangamonensis* M. and W. to the genus Phillipsia. *Griffithides parvulus* Girty. The surface is marked by granules of small nodes.

The author compares it with *G. ornatus*, but is much smaller and differs in the configuration of the basal portions of the glabella.

——— Fauna of the Batesville sandstone of Northern Arkansas.

Bull. No. 593, U. S. Geol. Sur., 1915.

The author describes *Griffithides mucronatus* nov. The same name was used by Traquair in 1862, for an Irish species of the genus, which Woodward, 1883, referred to *Phillipsia Eichwaldi* var. *mucronatus*.

Goldenberg (Fr.) Fauna Sarepontana Fossilis Die fossilen Thiere aus Steinkohlenformation von Saarbücken Hefts 1 and 2, 1875 and 1877.

Arthropleura affinis sp. nov., pl. 1, figs. 11-12.

Gorham (Frederic P.) The Cambrian deposits of North Attleboro.

Bull. No. 9, Roger Williams Park Mus., Providence, R. I., 1905.

The author illustrates from Shaler and Foerste's Bull. Mus. Comp. Zool. of Harvard Univ., 1888.

Olenellus Walcotti Shaler and Foerste may be identical with *Elliptocephala asaphoides* Emmons. *Microdiscus lobatus* Hall. *Ptychoparia attleborensis* S. and F. Aristozoe *Microdiscus belli-marginatus* S. and F. *Ptychoparia mucronata* S. and F. This may be *Atops trilineatus* Emmons. *Microdiscus speciosus*.

Grabau (A. W.) Guide to the Geology and Palæontology of the Niagara Falls and vicinity.

Bull. N. Y. State Mus., No. 45, vol. 9, 1891.

The author illustrates the Palæozoic crustacea of the New York Niagara Group with original figure of *Eurypterus remipes*.

——— Palæontology of the Cambrian Terraines of the Boston Basin.

Occasional Papers Boston Soc. Nat. Hist., vol. 4, part 3, 1901, pp. 601-694, plates 31-39.

Trilobita: *Olenellus (Holmia) Bröggeri* Walc. O. sp., *O. (Mesonacis) asaphoides* (Emm.), *O. Walcotti* S. and F. *Metadoxides magnificus* Matth. *Microdiscus belli-marginatus* S. & F., *M. lobatus* Hall, *M.* sp. *Strenuella strenura* (Bill.). *Argulos quadrangularis* Whitf.

The author represents a restored figure on p. 676, with 16 ? thorax segments, with measurements of the head, which varies in length, exclusive of the occipital ring, from

GRABAU (A. W.)—Continued

7 to 20 mm. *Ptychoparia Rogersi* Walc., *P.? attleborensis* S. and F. *Paradoxides Harlani* Green.

The author remarks that among the American relative of *Paradoxides Harlani* the most nearly related to the broad form is *P. regini* Matthew, from St. John Group; also *P. Bennetti* Salt.

The nearest relative of the narrow form is the *Paradoxides spinosus* the Bohemian species. Many years ago Linne Mus. Tessiniaum, 1753, p. 98, pl. 3, described under the name of *Entomolithus paradoxus* a trilobite of a wide form, about 6¾ inches long. Brongniart describes it as *Paradoxides Tessini*, using the narrow form of Wahlenberg's pl. 1, fig. 1, which he has copied.

The original, quoted from Dimbo, Sweden, by Linné, has never been again found in Sweden, the specimen may be one from Boston, Mass., obtained from the Boston Wharves by some Swedish naturalist in early days, the stones from the Braintree quarries were used in the Boston Harbor.

——— Guide to the Geology and Palæontology of the Niagara Falls and vicinity.

Bull. No. 45, vol. 9, 1901, New York State Museum.

The following Foss crustacea are described and illustrated:

Iscochilina cylindrica (Hall). *Leperditia scalaris* Jones, fig. 150. *Bollia symmetrica* (Hall), fig. 151. *Æhmina spinosa* (Hall), fig. 152.

Trilobita—*Homalonotus delphinocephalus* (Green), fig. 153. *Illaenus ioxus* Hall, fig. 154. *Dalmanites linulurus*, fig. 155. *Calymmene Blumenbachi Niagarensis* Hall, fig. 156. *Lichas Boltoni*, plate 17. *Encrinurus ornata* H. and W., fig. 157. *Bronteus Niagarensis* Hall, fig. 158. *Ceratiocaris acuminata* Hall, fig., *C. Physganocaris? Deweyi* Hall, fig. 160. *Eurypterus lacustris* Harland, *E. remipes* DeKay, fig., pl. 18, *E. pustulosus* Hall, *E. robustus* Hall, *E. pachychirus* Hall, *E. Dekayi* Hall. *Dolichopterus macrochirus* Hall. *Eusarcus grandis* G. and P. *Pterygotus macrophthalmus* Hall, *P. Cobbi* Hall, *P. globicaudatus* Pohl.

——— The Palæontology of Eighteen Mile Creek and Lake Shore sections of Erie County, New York.

Bull. Buffalo Soc. Nat. Sci., vol. 6, 1901, in four parts.

Ceratocaris Deweyi Hall, *C. acuminata* Hall.

——— Guide to the Geology and Palæontology of the Niagara Falls and vicinity.

Bull. Buffalo Soc. Nat. Sci., vol. 9, 1902.

——— and Sherzer (W. H.) The Monroe formation of southern Michigan and adjoining regions.

Michigan Geol. and Biological Sur. Geol., ser. 1, 1910.

Ostracoda—*Leperditia scalaris* Jones, *L. angulifer* Whitf., *L. attoides* nov., *L. alta Con. Kloedenia Monroensis* nov.

Trilobitae—*Proetus crassimarginatus* Hall.

Merostomata—*Eurypterus Eriensis* Whitf.

——— North American index Fossil Invertebrates.

Two volumes, New York, 1910, 909 pp., 726 figures.

Gives brief descriptions of genera and species. Appendices give tables of geological formation and a faunal summary showing distribution, also a classified bibliography.

Gronwall (Karl A.) Bornholm Paradoxideslag og deres Fauna Darnarks.

Geol. Under. II Rackke, No. 13, Kjobenhavavn, 1892.

Thirty-five species or varieties of the genus Agnostus are figured and described: *Agnostus aculeatus* Ang., *A. altus* n. sp., *A. atavus* Tbg., *A. bibullatus* Barr., *A. bidens* Meek, *A. bituberculatus* Ang., *A. brevifrons* Ang., *A. cambrensis* Hicks, *A. cicer* Tbg. and var. *forfex* n. var., *A. elegans* Tbg., *A. Eskriggei* Hicks, *A. exaratus* n. sp., *A. exsculptus* Ang. ex parte cf. *integra* Walc. and cf. *sulcifera* Walc. *Agnostus fallax* Lnrs. cf. *ferox* Tbg. and var. *insignis* Walc., *A. fissus* Lng. MS. and var. *perrugatan* var. and var. *trifissa* Matth. *Agnostus gibbus* Lnrs. and var. *hydrida* Br. *Agnostus gladiformis* Ang. and var. *resecta* n. var. *Agnostus incertus* Barr., *A. insularis* n. sp., *A. integer* Barr. and var. *spinosa* Pomp., *A. intermedius* Tbg., *A. Kjerulfi* Br., *A. laevigatus* Dalm., also var. *cicroides* Matth., var. *forfex* Br., var. *mammilla* Matth., var. *similis Br.* and var. *terranovica* Matth. *Agnostus lens* n. sp. and var. *frontosa* n. var., *A. lingula* n. sp., *A. Lundgreni* Tbg. and var. *nana* n. var., *A. Nathorsti* Br. and var. confiens Matth. *Agnostus nudus* Beyr., also var. *marginata* Br. and *scanica* Tbg. *Agnostus parvifrons* Linrs., also var. *mammillata* Br. and *nepos* Br. *Agnostus planicauda* Ang. and var. *vestgothica* Wall., *A. punctuosus* Ang., also var. *affinis* Br. and *bipunctata* Br. *Agnostus pusillus* Tbg., *A. quadratus* Tbg., *A. rex* Barr., *A. rotundus* n. sp., *A. stenorrhachis* n. sp., *A. tessela* Matth., *A. truncatus* Br. and *A. umbo* Matth. *Agralos ceticephalus* Barr., *A. depressa* n. sp., *A. difformis Ang., also var. aculeate* (Ang.) Br. and *acuminata* (Ang.) Br., *A. longicephalus* Hicks. *Anomocare Angelini* n. sp., *A. angustifrons* Tbg., MS., *A. excavatum* Ang., *A. laeve* Ang., *A. latelimbatum* Dames, *A. limbatum* Ang. *Anopolenus* Salter. *Apatocephalus* Br. *Arionellus* Ang. *Atops* Emmons. *Beyrichia Angelini* Barr. and var. *armata* n. var.

Cainatops Matth. *Carausia Meneviensis* Hicks. *Centropleura Henrici* Salt., *C. impar* Hicks, *C. Loveni* Ang., *C. Salteri* Hicks, *C. Steenstrupi* Ang., *C. venusta* Bill. *Conocephalina ornata* Br. The author uses Brögger's generic name, but does not define the genus. *Conocoryphe aequalis* Linrs., *C. Baileyi* Matth., *C. bufo* Hicks, *C. Dalmanni* Ang., *C. elegans* Walc., *C. emarginata* Lnrs., *C. glabrata* Ang., *C. Heberti* Berg., *C. Levyi* Berg., *C. pustulosa* Matt., *C. reticulata* Walc., *C. Sulzeri* v. Schloth., *C. tenuicincta* Lnrs., *C. trilineata* Emm., *C. (Erinnys) breviceps* Ang., *C. (Erinnys) venulosa* Salt., *C. (Ctenocephalus) coronata* Barr., *C. (Ctenocephalus) exsulans* Lnrs., *C. (Ctenocephalus) laticeps, C. (Ctenocephalus) Matthewi* Hartt, *C. (Ctenocephalus) Solvensis* Hicks, *C. (Ctenocephalus) tumida* n. sp., *C. (Liocephalus) impressa* Lnrs., *C. (Liocephalus) Linnarssoni* n. sp., *C. (Liocephalus) Lyelli* Hicks, *C. (Liocephalus) teres* n. sp. *Corynexochus bornholmiensis* n. sp., *C. Romingeri* Matt., *C. spinulosus* Ang., *C. umbonatus* Ang. *Dorypyge Curticei* Walc., *D. danica* n. sp., *D. desiderata* Walc., *D. Ellsi* Walc., *D. gothica* H. and W., also var. *acadica* Matth., *D. horrida* Matth., *D. oriens* n. sp., *D. quadriceps* H. and W., also var. *valida* Matth., *D. Richthofeni* Dames, *D. Slatkowskii* Fr. Schm. *Holocephalina inflata* Hicks, *H. primordialis* Salt. *Leperditia primordialis* Lnrs. *Liocephalus* n. subgen.

The new subgenus Liocephalus has as type species *C. impressa* Lnrs. and *C. Lyelli* Salt., and it is also probable that Salter's genus Holocephalina is to be referred hither.

Liostracus globiceps n. sp., *L. Linnarssoni* Br., *L. Maydelli* Fr. Schm., *L. microphthalmus* Ang., *L. platyrrhinus* n. sp. *Microdiscus pulchellus* Hartt, *M. punctatus* Salt., *M. scanicus* Lnrs., also cf. *cucentra* Lnrs. *Neolenus granulatus* Matth., *N. serratus* Rom. *Olenoides Fordi* Walc., *O. Marcoui* Whitf., *O. nevadensis* Meek.

Paradoxides Abenacus Hartt, *P. bohemicus* Boeck, *P. brachyrrhachis* Lnrs., *P. Davidis*

GRONWALL (Karl A.)—Continued

Salt., *P. eteminicus* Matth., *P. Forchhammeri* Ang., *P. Harknessi* Hicks, *P. Hicksii* Salt., also var. *palpebrosa* Lnrs., *P. lamellatus* Hartt, *P. mediterraneus* Pomp., *P. Pingelii* (nov. Beck MS.).

Grönwall, p. 107, refers *Paradoxides Davidis* Salt., to *P. Pingelli* Beck MS. The author refers to an unpublished plate 43 of Angelin's fasc, on which *P. Davidis* Salt. is reproduced under the name of *P. Pingelii* Beck MS.

Paradoxides pradoanus Barr., *P. rugulosus* Corda, *P. Sjögreni* Lnrs. and var. *nepos* n. var., *P. spinosus* Boeck, *P. Tessini* Brong., *P. tumidus* Ang., *P. Ölandicus* Sjögr., *P.* sp. indet. Nos. 1-3.

Ptychoparia Johnstrupi n. sp., *P. striata* Emmr. *Solenopleura acadica* Whiteave's MS. and var. *elongata* Matth. *Solenopleura brachymetopa* Ang. and var. *alutacea* Br., also *nuntia* n. var., *S. bucculenta* n. sp., *S. canaliculata* Ang., *S. holometopa* Ang., *S. parva* Lnrs. *Zacanthoides Eatoni* Walc., *Z. flagricaudus* White, *Z. humerosus* Salt., *Z. levis* Walc., *Z. spinosus* Walc., *Z. typicalis* Walc.

Gortani (Michele). Contribuzioni allo studio del Palæozoico Carnico Le Fauna a Climenie del Monte Primosio.

Mem. R. Acad. Sci. Bologna, ser. 6, vol. 6, 1907, pp. 201-243, plates 1-2.

The author divides the genus Trimerocephalus McCoy into the subgenus *Eutrimerocephalus.* In which he places *T. laevis* Münster, *Phacops (Trim.) anophthalmus* Frech, *P.(Trim.) carithiacus* Frech, and a new species under the title of *Trimerocephalus (Eutrimerocephalus) carnicus.* This series without eyes.

2—Subg. Microphthalmus with small eyes slightly faceted. The author places under this: *Trimerocephalus (Microphthalmus) cryptophthalmus* Emm., *T. (M.) pseudogranulatus sp.* nov., *T. (M.) mastophthalmus Richter* sp., *T. (M.) Roemeri* Gortani, *T. (M.) macrocephalus Richter* sp., *T. (M.) incisus* Roemer sp., *T. (M.) acuticeps* Kayser.

Under the genus Proetus the author records one species. *Proetus* cf. *Phocion* Billings, 1874; a small tail only. Under Dechenella the author records two species. Fragments of the head so far only figured. *Dechenella Vinassasi* n. sp., Rudf. Richter refers this to *Cyrtosymbole vinassai* (Gortani), also the other species *Dechenella italica.*

Gortani (M.) and **Regny** (P. Vinassa). de Fossili neosilurici del Pizzo di Timau e dei Pal Nell'alta Carnia.

Memoria Acad. Sci. Bologna, ser. 6, 1909, p. 87-119, plate 1.

The fossil Crustacea indicated by the authors are Ostracoda Aparchites indt. compared with *A. mitis* Jones and *Lindströmi* Jones.

Trilobites: *Encrinurus Beaumonti* Barr. var. *Nováki* Frech, *Proetus* n. f. *(foveolatus* n. sp.) The authors illustrate moveable cheek of this species comparing it with *Proetus crassiimargo* Hall.

Harpes crassifrons Barr. var. *forojuliensis* n. sp. The authors illustrate a fragment of the head of this species.

Groom (T. T.) On a new Trilobite from the Dictyomena shales of Malvern Hills.

Geol. Mag. London, Dec. IV, vol. 9, 1902, pp. 70-73, 4 figures.

Acanthopleurella Grindrodi n. gen. et sp.

The conformation of the head suggest Trinucleoid affinites, but there is no marginal rim, and the rest of the body appears to show Olinid characters. Shumardia is possibly an ally, but the new genus differs in the extension of the glabella to the front margin of the head, in the absence of glabella furrows, and in the spinous prolongation of the thoracic pleurae.

Gümbel (C. W.) Geognostische Beschreibung des Fichtegebirges. 1879.

The author refigures the original of *Trinucleus laevis* Münster with eyes, together with granulations over the surface of the head shield. He identifies *Trinucleus laevis* Münster with *phacops cryptophthalmus.*

Gortani, 1909, p. 229, refers Münster's species to *Trimerocephalus. (Eutrimerocephalus) laevis* v. Münster.

Gunther (A. F.) Ueber die Trilobiten u Rudisten.

Sitzber, d. Ges Isis, Dresden, Jhg., 1869 (1870), pp. 12-15.

Sao hirsuta Barr.

Gürich (Georg). Das Palaeozoicum des Polnischen Mittelgebirges.

Verhandl d Russ Kaiseri Mineralog Ges, vol. 32, 1896.

Arthropoda, pp. 353-373, plates 10 and 15.

The work contains descriptions and illustrations.

Agnostidae: *Agnostus fallax* Linnr. *A. gibbus* Linnr.

Olenidae: Paradoxides of Tessini Brong.

Concephalidae: *Liostracus Linnarsoni* Brögger.

Broteidae: Bronteus sp., *B. Kielcensis* n. sp.

The author refers *B. flabellifer* var. F. Roemer Z. D. Geol. Ges., 1866, p. 671, pl. 15, fig. 1a-c 6 to this new species.

Phacopidae: *Trimerocephalus typhlops* sp. nov.

Frech gives the name of *Phacops anophthalmus* for *Phacops cryptophthalmus* Emmr. (F. Roemer Z. D. Geol. Ges, 1866, pl. 13, figs. 6-7.)

Gürich refers it to his new species.

Trimerocephalus sp.

Phacops caecus n. sp. (a species without eyes), *P. Posidoniae* n. sp., *P. Schlotheimi* Bronn. and *P. latifrons* Br. *Cryphaeus lacinatus* F. Roemer.

The author refers *C. Grootei Beushausen,* 1884, to this species.

The author gives the name of *Cryphaeus Kayseri* for Kayser's Cryphaeus Lethaeae Faunades Hauptquarzites der Wiedaer Schiefer, p. 86.

Acidaspidae: Two species.

Proetidae: *Cyphaspis ceratophthalmus* Goldf., *C.* sp. *Proetus* cf., *cornutum* Goldf., *P. margaritaceus* n. sp. *Dechenella Dombrowiensis* n. sp. Richter refers this to his new subgenus Basidechenella. *Dechenella polonica* n. sp. Ritcher refers this to his new subgenus Eudechenella. *Dechenella pusilla* n. sp. Richter refers this to the new genus Cyrtosymbole.

Ostracoda: pp. 374-391.

Entomidae: *Entomis migratoria* n. sp., *E. serratostriata* Sandb., *E.* sp., *E. tenera* n. sp., *E. angulosa* n. sp., *E. vittata* n. sp., *E. scabra* n. sp., *E.* cf. *gyratan* Richter, 1869.

Entomis sp. (cf. *nitidan* F. A. Roemer, Beit, pl. 4, fig. 20).

Leperditidae: *Leperditia phaseolus* His. Silurian.

Leperditia Amphiporae n. sp. Devonian. *Bolbozoe polonica* n. sp.

New genus Antitomis, type *A. bisulcata* n. sp.

Trigonocaris dubia n. sp.

Primitia humiliformis n. sp., *P. obliqua* n. sp., *P. ornatissima* n. sp., *P. plana* n. sp., *P. lentiformis* n. sp., *P. fabaeformis* n. sp., *P. Calceolae* n. sp. *Primitia* sp., *P. entomidella* n. sp. *Primitiopsis piciformis* n. sp.

Aparchites sp.

Beyrichia Kloedeni McCoy, *B.* cf. *Buchianan* R. J., *B.* cf. *Salterianam* R. J. *Kloedenia* cf. *Wilkensianam* R. J.

GURICH (Georg)—Continued

Bollia sp.

New genus Polyzgia, type *P. symmetrica.*

New genus Połoniella, type *P. devonica.*

Bythocypris polaris n. sp. *Bairdia devonica* n. sp.

——— Nachtrage zum Palaeozoicum des Polnisschen Mittlegebirges.

Neuen Jahrb. für Mineral Geol. and Palaeont. Beilarge, Band XIII, 1900, pp. 331-388, plates 14 and 15.

The author describes several new species of Trilobites, which he illustrates as *Illaenus polonicus* nov. sp., which he compares with *I. parvulus* Holm and *Panderia minima* Volborth. *Aeglina Kontkiewiczi* nov. sp., figure of the pygidium. *Proetus margaritaceous* Gür., fig. in text, *P. pyriformis* sp. nov., fig. of glabella, *P. Michalskii* Gür. *Dechenella pusilla* Gür. *Beyrichia trigonata* Gür.

——— Jura und Devon Fossilien von White Cliff, Australien.

Neuen Jahrbuch für Min. Geol. and Palaeont. Beilage, Band xiv, pp. 484-539, plates 18-20, 1901.

The author describes a new genus of Lichas as Craspedarges including under it one species, *C. Wilcanniae* Gürich. He also gives figures of *Euarges meridionalis* Frech and *E. granulosus* F. A. Roemer. The author uses as subgenera to Lichas the following subgenera:

Ceratages for the preoccupied term Arges Goldf., with *L. armatus Goldf.* for its type.

Plusiages for Corydocephalus Corda, owing to the uncertainty attached to Corda's types, Type *L. palmatus* Barr.

Liparges substituted for Corda's Dicranoymus, type *L. simplex* Barr.

Trachylichas name proposed in place of Dicranopeltis Corda, type *Lichasscarba* Beyr.

Echinolichas Gurich type *L. eriopis* Hall.

Metopolichas used for preoccupied name Metopias Eichw., type *L. Hubneri* Eichw.

Platopolichas Gurich, type *L. avus* Barr.

Platylichas, type *Lichas margaritifera* Nieszk.

Dr. Gurich takes *Platymetopus Holmi* Schmidt as the type of this genus, but it should be abandoned for the group, as it was used by Dejean in 1829 for a genus of insects.

Pterolichas for *Arctinurus Boltoni.*

Platynotus was used by Conrad in 1838 for the same species.

Euages for preoccupied term Acanthopyge Corda, type *L. Haueri* Barr.

Leiolichas Schmidt, type *L. illaenoides* Nieszk.

Homolichas Schmidt, type *L. depressus* Ang.

Hoplolichas Dames, type *L. tricuspidata* Beyr.

Ceratolichas Hall and Clarke, type *L. gryps* Hall.

Conolichas Dames, type *L. aequiloba* Steinhardt.

Hemiarges Gurich, type *L. Wesenbergensis* Schmidt.

Platymetopus Ang., type *L. planifrons* Ang. (Amphilichas Raymond).

Oncholichas Schmidt, type *L. ornatus* Ang.

Hall (James). Relations of the genus Eurypterus.

Proc. Am. Acad. Arts and Sci., vol. 4, 1860, p. 353.

——— On the genus Eurypterus.

Trans. Albany Inst., vol. 4, 1860, p. 280.

HALL (James)—Continued

——— Preliminary notice of the Fauna of the Potsdam sandstone, with remarks upon previously known species of fossils and descriptions of some new ones from the sandstone of the Upper Mississippi Valley.

Trans. Albany Institute, vol. 5, 1867, pp. 93-195, with six plates.

A notice of this paper was read before the Albany Institute April 29, 1862, and by an arrangement between the Publishing Committee and the Regents of the University, it was published in the 16th Report on the State Cabinet, pp. 119-226. The starred pages 135 and 136 were not issued in the Trans. Albany Inst.

On page 193 of the Trans. Albany Inst., the text contains figures of *Pemphigaspis bullata,* also figures of *Amphion? matutina, Conocephalites (Arionellus) dorsalis* and *C. optatus,* not republished in the text of the 16th Report N. Y. State Cabinet, but included in Plate V. A. except *C. dorsalis.*

For list of fossil Crustacea, see 16th Report N. Y. State Cabinet, 1863; also Contributions to Palæontology from investigations made during the years 1861-1862.

Harbort (E.) Ueber mitteldevonische Trilobitenarten im Iberger Kalk bei Grund im Harz.

Zeitschr. Deutsch. Geol. Ges Bd., 55 Jahrg, 1903, pp. 474-485, 2 plates.

Acidaspis pigra Barr. *Cyphaspis ceratophthalma* Goldf., *C. convexa* Barr. *Bronteus granulatus* Goldf., *B. flabellifer* Goldf. *Harpes* cf. *socialis* Barr., *H. convexus* Trenkn.

Haynes (Winthrop P.) Discovery of bivalve Crustacea in the coal measures near Pawtucket, R. I.

Science N. S., vol. 37, No. 944, pp. 191-192, 1913.

The author records the discovery of the carapaces of bivalve Crustacea of the genus Leaia and Estheria from the Narragansett Basin coal measures, which the author compares with *Leaia tricarinata* Meek and Estheria not sufficiently well preserved to determine.

Henderson (John). Short notices of three species of Trilobites from Silurian Beds of the Pentland Hills.

Trans. Edinburgh Geol. Soc., vol. 1, pt. 1, 1868, pp. 21-23.

The author mentions *Phacops Stokesii* and *Calymmene Blumenbachii.* He remarks that the species described as *Encrinurus expansus* by Haswell, in his Geology of the Pentland Hills, must not have been perfect, as he omitted any description of the free cheeks or facial suture. The author refers the *Zethus Pageii* Haswell to the free cheek of *Encrinurus expansus.* This species is broadly ovate, length about one and one-fourth of an inch; breadth two-thirds of the length, cephalic shield, semi-circular tuberculated posterior angles rounded; the glabella pear-shaped, convex, and covered with tubercles, and punctured between the tubercles; large tubercles, occupying the place of lateral lobes; cheeks triangular convex and embracing the front of the glabella; eyes pedunculated and placed between the centre of the cheek; and the glabella obovate and covered with a fine net work of facets.

——— Notice of *Silimonia acuminata* from the Silurian of the Pentland Hills.

Trans. Edinburgh Geol. Soc., vol. 1, 1870, pp. 18-19.

— On some recently discovered fossiliferis beds in the Silurian rocks of the Pentland Hills.

Trans. Edinburgh Geol. Soc., vol. 3, 1880, pp. 353-356.

Herrick (C. L.) Observations upon the so-called Waverly Group of Ohio.

Geol. Ohio, vol. 7, 1893, pp. 495-515, plates 14-24, Chapter IV.

Proetus praecursor Herrick. *Phaethonides spinosus* Herrick. *Phillipsia meramecensis* Shumard. *Proetus minutus* Herrick. *Phillipsia serraticaudata* Herrick. *Phaethonides immaturus* Herrick, *P. occidentalis* Herrick. *Proetus* sp. ?, *P. auriculatus* Hall.

This chapter is a summary of the results of observations published in the Bulletins of Denison University, the American Geologist, and the Bulletins of the American Geological Society.

The plates are from the Bull. Denison University.

Hind (G. J.) and **Fox** (H.) On Radiolarian rocks in the Lower Culm.

Quart. Jour. Geol. Soc., vol. 51, p. 609.

Trilobites by Dr. Henry Woodward, pp. 646-649.

Phillipsia Leei Woodw., *P. minor* Woodw. *Phillipsia* larval form.

Griffithides acanthiceps Woodw., *G. longispinus* Portl. *Proetus species* A-B.

Hitchcock (C. H.) Notice of a new species of Acidaspis from a boulder of Marcellus shale found in drift at West Bloomfield, New Jersey.

Bull. Am. Mus. Nat. Hist., vol. 19, 1903, pp. 97-98, plate 6.

The author describes *Acidaspis Whitfieldi* n. sp., which he compares with *Acidaspis mira* Barr., but the new species is rather more complicated in the distribution of the spines.

Hochsteetter (F.) Silursuiten (12 Gypsabgüssen seltener Trilobiten).

Verh. d. k. k. Geol. Reichsanst, Wien Jhg., 1877, p. 74.

Hoek (P. P. C.) Neues Jahrb für Min. Geol. and Pal., 1912.

Hoenes (R.) Die Trilobiten Gattung Phacops und Dalmanites.

Jahrb. k. k. Geol. Reich., 1880, vol. 30, part 4, pp. 657-686.

Ordovician: *Dalmanites Angelini* Barr., *D. atavus* Barr., *D. Deshayesi* Barr., *D. Hawlei* Barr., *D. Morrisiana* Barr., *D. orba* Barr., *D. Phillipsi* Barr., *D. socialis* Barr. and var. *proaeva* Emm., also var. *grandis*.

Silurian: *Dalmanites auriculata* Dalm., *D. cristata* Corda, *D. Fletcheri* Barr., *D. Hausmanni* Brongn., *D. McCoyi* Barr., *D. Reussi* Barr., *D. spinifera* Barr. *Phacops rugosa* Corda, *P. spinifera* Barr., *P. Glockeri* Barr., *P. Boecki* Corda, *P. breviceps* Barr., *P. Bronni* Barr., *P. bulliceps* Barr., *P. cephalotes* Corda, *P. emarginatus* Barr., *P. fecundus* Barr., *P. Hoeninghausi* Barr., *P. intermedius* Barr., *P. miser* Barr., *P. Signatus* Corda, *P. Sternburgi* Corda, *P. trapeziceps* Barr., *P. Volberthi* Barr.

The author discusses:

1. Characteristic of the genera *Phacops* and *Dalmanites;* similar and dissimilar features.

2. The group of *Dalmanites socialis* and their relationship to those of the *Dalmanites Hausmanni;* also to the genus *Phacops.*

3. The group of *Phacops Glockeri* as connecting link between *Phacops* and *Dalmanites.*

4. The probable evolution between the genera *Phacops* and *Dalmanites.*

Holm (G.) Ueber eine neue Bearbeitung des *Eurypterus Fischeri* Eichw.

Acad. Imp. Sci. Bull., St. Petersburg, ser. 5, vol. 4, p. 369.

——— Om förekomsten af en Pterygotus i Dalarnes öfversilur.

Geol. För. i Stockholm Förhandl, vol. 19, 1897, p. 475.

Holm (Gerhard). Palaeontologiska Notiser 1-10.

Sveriges Gel. Unders. Afh., ser. C, No. 176, 1902.

Olenellus skifern vid Tomten Ringsaker's socken.

4. Om *Bohemilla ? denticulata* Linrs. och *Remopleurides microphthalmus* Linrs. This forms the type of *Robergia*, a new genus by Moberg, 1907.

6. Om forekomsten af en *Pterygotus* i Dalarnes Oversilur.

7. Om Angelin's *Bronteus ? nudus Illaenus (Bumastus) nudus.*

8. Om kinden hos *Illaenus punctillosus* Tornq.

9. On ett fullständigt examplar af *Pseudo-sphaerexochus laticeps* Linrs.

Illustrations of *Illaenus punctillosus* Tornq. *Pseudo-sphaerexochus laticeps* Linrs.

—— Palaeontologiska Notiser.

Geol. Foren. i Stockholm Forhandl, Bd. 19, p. 169, 1897.

Ueber Dikellocephalus and Olenellus Mickwitzi.

——— Palaeontologiska Notiser 13.

Geol. Foren. i Stockholm Forhandl, Bd. 21, Häft 1, 1899.

Om den yttre anatomien hos *Eurypterus Fischeri*, 4 plates.

——— Ueber die organisation des *Eurypterus Fischeri* Eichwald.

Mem. Acad. Petersburg, ser. 3, vol. 8, 1899, pp. 1-57, plates 1-10.

Eurypterus Fischeri Eichwald. *Dolichopterus laticeps* Fr. Schm.

The close similarity approaching identity of *Eurypterus Fischeri* to *E. remipes* and *E. lacustris*, American forms, suggested to Dr. Schmidt that the difference between the Baltic and American forms were only geographical variations arising through migration. With this idea Clarke and Ruedemann have concurred.

Holzapfel (E.) Das obere Mitteldevon in Rheinischen Gebirge. Berlin, 1895.

Proetus Cuvieri Stein, *P. Holzapfeli* Burhenne. Richter refers this to *P. cornutus* Goldf.

Cyphaspis ceratophthalma Goldf.

Houding (Van). Trilobieten und Limulus.

Album der Natuur, 1899, p. 24.

Hussak (E.) Ueber Trilobiten.

Jahresber d'Acad. Naturwiss ver Graz. Jahrg., 1875, pp. 35-36.

Illés von (A.) Magyarországon talált elsö Trilobita.

Foldtani Kozlony, vol. 22, 1902, pp. 351-354.

Griffithides Dobsinensis n. sp., figs a-b.

The author illustrated part of the thorax and pygidium; compares *Griffithides verrucosus* Gemmellaro, 1890.

——— Die erste in ungarn gefundene Trilobite.

Foldtani Kozlony, vol. 22, 1902, pp. 408-411, figs. a-b.

The same in the German language.

Illing (V. C.) Notes on certain Trilobites found in the Stockingford Shales.

Brit. Assoc. Adv. Science, 83 Ann. Meeting, Sec. C, 1913.

Abstract in Geol. Mag., Dec. V, vol. 10, p. 452, 1913.

The author remarks that among the fossils found at Hartshill Hayes, numerous forms occur, representing young stages in the development of certain Trilobites. Among these are the following:

1. Liostracus sp., similar to one described by G. F. Matthew.
2. Holocephalina sp. The early stages of this genus possess a well-marked glabella, widening anteriorly.
3. *Paradoxides Hicksii.*
4. Certain new forms of Agnostus.

Jackel (O.) Ueber die Organisation der Trilobiten.

Zeitschr. Deutsch Geol., Ges. 53, 1901, pp. 133-171, plates 4-6.

——— Ueber verschhiedene Wege Phylogonetischer Entwickelung.

Verhandl. des V. Internationalen Zoologen Congresses zu Berlin, 1901, pp. 1058-1117, 28 figures in text.

Evolution of Trilobites, pp. 1086.

The author illustrates Phacops, Agnostus and Olenus, fig. Nos. 20-24.

On the evolution of Gigantostraca, p. 1105.

——— über die Agnostiden.

Zeit. d. Deutsch Geol. Ges., vol. 61, 1909, pp. 380-401, figures 1-23.

The author proposed Paragnostus with *Agnostus rex* as its type. This was the type of Corda's Condylopyge. He further proposed Dichagnostus with *Agnostus granulatus* as the type duplicating Corda's Pleuroctenium. The author gives the name of Mesagnostus for *A. integer* Beyr., which was used for Corda's genus Peronopsis.

Miagnostus Jackel has the same type species, *A. laevigatus* Dalm., as Lejopyge Corda. The new genus Leiagnostus, which has the same generic characters as Phalocroma Corda.

Metagnostus erraticus and *A. glabratus* have the same short glabella with faint basal lobes as *Agnostus tardus* Barr., which was the type of Corda's Arthrorhachis.

Vogdes, in Am. Geol., vol. 9, 1892, p. 395, in his paper on North American species of the genus Agnostus, uses this term for section IV.

The author arranges the families as follows:

1. Fam. Paragnostidae. Paragnostus n. gen., type *A. rex* Barr.

Dichagnostus n. gen., type *A. granulatus* Barr.

Diplagnostus, type *A. planicauda* Ang.

Mesagnostus n. gen., type *A. integer* Barr.

2. Fam. Metagnostidae.

Metagnostus n. gen., type *M. erraticus* n. sp.

Hypagnotus n. gen., type *A. parvifrons* Linnrs.

3. Fam. Agnostidae sensu stricto.

Agnostus sensu stricto, type *A. pisiformis* Linné.

Pseudagnotus n. gen., type *A. cyclopyge* Tullberg.

4. Fam. Leiagnostidae.

Ptychagnostus n. gen., type *A. reticulatus* Ang.

Miagnostus n. gen., type *A. laevigatus* Dalman.

Leiagnostus n. gen., type *L. erraticus* n. sp.

Jahn (J. J.) Ueber das Tejrovicer Cambrium, Bohmen.

Verhandl. k. k. Geol. Reichs, 1893, p. 271.

Arionellus spinosus n. sp.

This species is illustrated by Pompeckj Die Fauna des Cambrium von Tejrovic, p. 548, pl. 17, figs. 14-20.

Jarosz (J.) Fauna des Kohlenkalk in der Umgebung von Krakau I Teil. Trilobiten.

Acad. d. Wissensch. in Krakau Math. Naturw., Kl., fur 1909, 2 Semester, Krakau, 1910.

Jones (T. R.) and **Woodward** (Henry). On some Scandinavian Phyllocardae, Part 2.

Geol. Mag., Dec. 3, vol. 5, 1888, p. 145.

Ceratiocaris Scharyi Barr., *C. pectinata* J. & W. *Phasganocaris pugio* Barr. var. *serrata* J. & W. *Ceratiocaris Angelini* J. & W.

——— Notes on Dr. G. F. Matthew's Cambrian Ostracoda from North-eastern America.

Geol. Mag., Dec. IV, vol. 9, 1902, pp. 401-403.

Outline figures of the genera—Indiana, Bradorona, Beyrichona, Hipponicharion, Bradoria and Escasona.

——— Note on a Palæozoic Cypridina from Canada.

Geol. Mag., Dec. V, vol. 1, 1904, pp. 438-439, fig.

Cypridina antiqua n. sp.

——— On some Isochilinae from Canada and elsewhere in North America.

Geol. Mag., new ser., Dec 4, vol. 10, 1903, pp. 300-304.

Isochilina gregraria (Whitf.), var. *Ulrichiana* nov. Tetradella. sp. .

——— Some Palæozoic Ostracods from Maryland.

Johns Hopkins Univ., Circ., 1905, No. 3, pp. 20-33.

——— and **Kirby** (J. W.) Sur une Leperditia (Primitia) nouvelle du calcarire carbonifere de la Belgique.

Ann. Soc. Geol. de Belgique, vol. 20, 1893, plate.

The species described as *Leperditia Dewalquei* is now referred by authors to the genus *Primitia.*

——— Notes on Palæozoic Bivalved Entomostraca No. xxxii.

Ann. Mag. Nat. Hist., ser. VI, vol. 16, 1895, pp. 452-460, plate.

Bairdia Hisingeri Munster. *Bythocypris cornigera* J. & K. *Phreatura concinna* J. & K. *Cytherella intercalaris* n. sp. *Youngiella rectidorsalis* J. & K. *Bairdia plebeia* Reuss var. *alta* n. var., *B. Hisingeri* var. *contracta* n. var. *Argillaecia (Bythocypris) aequilis* J. & K. *Bythocypris breviata* n. sp.

——— Quelques Ostracodes fossiles de la Belgique.

Traduit par G. Dewalque, Liege, 1896, plate.

Leperditia Okeni Munster, *L. Okeni* var. *gracillis* n. var., *L. obtusa* n. sp., *L. consorbrina* n. sp., *L. Briarti* Dewalque. *Schmidtella belgica* n. sp. *Primitia Dewalquei* n. sp.

See also Ann. Soc. Geol. de Belgique, vol. 23, 1896.

JONES (T. R.)—Continued

——— On the fossil Cypridinidae and some allied Ostracoda.

Ann. Mag. Nat. Hist., 7th ser., vol. 1, 1898, pp. 333-344, plate.

List of fossil Cypridinidae with illustrations of—

Cypridina primaeva McCoy. *Bradycinetus Rankianus* J. & K. *Philomedes? Bairdiana* J. & K. *Cyprosina Whidbornei* Jones. *Cypridinella MacCoyiana* J. & K., *C. Burrovii* J. & K. *Cypridinella Koninckiana* Jones. *Cyprella annulata* DeKon. *Cypridina? (Leperditia?* von Toll.) Silurian, *C.? polonica (Bolbozoe* Gurich), Upper Silurian, *C. Grayae* Jones, Lower Silurian, *C. Raisiniae* Jones, Lower Silurian.

— — Contributions to Fossil Crustacea.

Geol. Mag., Dec. IV, vol. 6, 1899, pp. 388-395.

Bellinurus grandaevus n. sp. *Leaia Leidyi* Jones. *Hibbertia orbicularis* gen. et sp. nov.

The genus is placed by the authors along with and nearer to those forms referred to the genus Cyclus than with any other group.

Anthrapalaemon glaber J. & W. *Echinocaris Whidbornei* J. &. W. *Estherina extuberata* n. sp.

——— The Eurypterus bearing rocks of the Pentland Hills.

Report Brit. Assoc., 1900, pp. 557-558.

——— Bather (R. A.), and Chapman (F.) On some fossils of Wenlock age from Mulde near Klinteberg, Gotland. With notes by Prof. Jones and Dr. Bather.

Ann. Mag. Nat. Hist., 7th ser., vol. 7, 1901, pp. 141-160, plate.

Family Leperditiidae: *Primitia valida* J. & H., also var. *breviata* J. & H. and var. *angustata* J. & H., *P. fabulina* J. & H., *P. elongata* Krause, *P. punctata* Jones, *P. humilis* J. & H., *P. ornata* J. & H., *P. reticristata* Jones, *P. mundula* Jones.

Sub-family Beyrichiinae: *Kloedenia apiculata* Jones, *K. gotlandia* n. sp.

Bollia auricularis Jones. *Beyrichia concinna* J. & H., *B. muldensis* n. sp., *B. Jonesii* Boll., *B. Kloedeni* McCoy, var. *tuberculata* Salter, *B. tuberculata* (Kloeden) var. *lineato-tuberculata* n. var., *B. Bolliana umbonata* Reuter, *B. clavata* Kolmodin.

Family Cytheridae?: *Cythere Vinci* Jones ?. *Cythere subquadrata* Jones. *Thlipsura plicata* var. *unipunctata* Jones, *T. v-scripta* J. & H. *Æchmina bovina* Jones and var. *punctata* Krause. *Primitiopsis planifrons* Jones.

Family Cypridídae: *Pontocypris Mawii* Jones., *P. Mawii* var. *proxima* Jones.

Family Bairdiidae: *Macrocypris siliquoides* Jones. *Bythocypris symmetrica* Jones, *B. symmetrica* var. *obesa* Jones, *B. phaseolus* Jones, *B. Hollii* Jones, *B. Hollii* var. *oblonga* Jones.

Family Cytherellidae: *Cytherella Smithii* Jones.

Trilobita: *Phacops (Dalmanites) limulurus Hall* (Green's sp.).

The authors illustrate *Beyrichia Muldensis, B. tuberculata* var. *lineato-tuberculata Kloedenia Gotlandica* n. sp.

Jonker (H. G.) Bijdragen tot de kennis der Sedimentaire Zwerfsteenen in Nederland. Contributions to a knowledge of the sedimentary erratic blocks in the Netherlands.

Amsterdam Verh. K. Akad., Wet. 2, part 12, No. 3, 1906, pp. 1-33, pl. 1.

Kayser (E.) Die Fauna des Hauptquartzits und zorger Schiefer des Unter-Harzes.

Abhandl. K. Preussischen Geol. Land., vol. 10, 1889, part 1.

KAYSER (E.)—Continued

Phacops Potieri Bayle. *Homalonotus (Dipleura)* sp., *H. multicostatus* Koch?. *Cryphaeus Lethaeae* n. sp. *Cryphaeus* sp. *Phacops* aff. *fecundus* Barr.

—— Ueber einige neue order venig gekannte Versteinerungen des rheinischen Devon.

Zeitschr. Deutsch. Geol. Ges., vol —, 1889, pp. 288-926, plate.

Phacops (Trimerocephalus) acuticeps n. sp.

— — Die Fauna des Dalmanitensandsteins von Kleinlinden bei.

Giessen, Marburg, 1896, 42 pp., 5 plates.

Odontochile hassiaca n. sp., *O.* sp. *Phacops Frechi* Kays. *Cheirurus gibbus* Beyr. *Cyphaspis ceratophthalma* Goldf. *Bronteus (Thysanopeltis) laciniatus* Sandb.? *Phacops* cf. *Sternbergi* Corda.

—— Beitrage zur Kenntnis einiger Palæozoischer Faunen Sud Americas.

Zeitschr. Deutsch. Geol. Ges., vol. 49, 1897, pp. 274-317, plates.

Liostracus Steimanni n. sp., *L. Ulrichi* n. sp. *Agnostus irugensis* n. sp. *Olenus argentinus* n. sp. *Conocoryphe* (subgen.) *Crepicephalus.*

—— Weiteŕer Beitrage zur Kenntnis der älteren Palæozoischen Faunen Sud Amerikas.

Zeitscher. Deutsch. Geol. Ges., vol. 59, 1898, pp. 423-429, plate 16.

Megalaspis sp., *M. Brackebuschi* n. sp., *M. planilimbata* Ang. *Pterygometopus saltaensis* n. sp.

Thysanopyge argentina n. sp. et n. gen.

The new genus was established on a pygidium, similar to that of *Dalmanites caudata* and certain species of *Megalaspis.*

The main peculiarity of this new type consists of the tooth-edged limb of the pygidium, in other features it corresponds with the genus *Megalaspis.*

Keyes (Charles R.) Missouri Geol. Survey, vol. 4, part 1, 1894, Palæont. Missouri Crustaceans, Chap. X, p. 226.

Lichas Boltoni Bigsby. *Illaenus Graftonensis* M. & W., *I. insignis ?* Hall. *Acidaspis hamata* ? Conrad. *Cyphaspis Girardeauensis* Shumard. *Encrinurus deltoides* Shumard. *Dalmanites tridentifera* Shumard. *Acidaspis Halli* Shumard. *Calymmene senaria* Conrad, *C. rugosa* Shumard. *Ptychoparia conica* ? Billings. *Proetus Missouriensis* Shumard, *P. Swallovi* Shumard. *Phillipsia Sedaliensis* Vogd., *P. Sampsoni* Vogd., *P. tuberculata* M. & W., *P. Missouriensis* Shumard, *P. Meramecensis* Shumard, *P. Portlocki* M. & W., *P. major* Shumard, *P. ? immaturus* Herrick. *Leperditia sublaevis* Shumard. *Solenocaris Sancti-Ludovici* Worthen. *Colpocaris Chesterensis* Worthen.

Plate 32 illustrates *Illaenus insignis, Cyphaspis Girardeauensis, Dalmanites tridentifera Acidaspis Halli, Calymmene niagarensis Phillipsia tuberculata, P. Portlocki* and *P. major.*

Kindle (E. M.) and **Breger** (C. L.) The Stratigraphy and Palæontology of the Niagara of Northern Indiana. Geol. Sur. Indiana, 28 Ann. Report, 1903, p. 397.

Under the title of Trilobita the authors describe and illustrate (plate XXII-XXIV): *Illaenus armatus* Hall, *I. insignis* Hall, *I. ioxus* Hall. *Ceratocephala goniata* Warder. *Odontopleura ortoni* Foerste. *Encrinurus indianensis* n. sp. *Calymmene Vogdesi* Foerste. *Ceraurus (Crotalocephalus) niagarensis* Hall. *Sphaerexochus romingeri* Hall. *Phacops* cf. *pulchellus* Foerste. *Dalmanites (Synphoria) vigilans* Hall.

The new species *Encrinurus Indianensis* of the Niagara Group has a semi-circular cephalon, test tuberculated. Glabella with 3 strong tubercles on each side, anterior to the occipital groove; fixed cheeks separated from the glabella by deep dorsal grooves; genal angles spined; pygidium elongated, triangular, convex; axis 15 joints; lateral ribs 10. Each ring of the axis has 3-5 tubercles, the median one being the strongest.

Compares *E. variolaris*.

Kindle (E. M.) The Onondaga Fauna of the Alleghany Region.

Bull. 508, U. S. Geol. Sur., 1912, 144 pp. with 13 plates.

The author notes and illustrates the following Crustacea:

Phacops rana Green, *P. cristata* Hall, with var. *pipa* Hall. *Cryphaeus* cf. *Boothi* var. *callitelcs* (Kayser). *Dalmanites (Coronura) aspectans* Conrad. *Odontocephalus sclenurus* (Eaton), *O. aegeria* Hall. *Phaethonides gemmaeus* H. & C. *Conolichas* cf. *hispidus* H. & C. *Cyphaspis* cf. *stephanophora* H. & C. *Lichas (Arges) contusus* H. & C. var. *Acidaspis callicera* H. & C. *Dalmanites* sp. undet.

Ostracoda: *Bollia ungula* Jones, *B. obesa* Ulrich. *Bythocypris favulosa* Jones. *Ulrichia conrandi* Jones. *Octonaria stigmata* Ulrich. *Leperditia* cf. *subrotunda* Ulrich.

The above list of 13 species contains three trilobites known in the Hamilton fauna. One, *Phaethonides gemmaeus*, is common to the Onondaga and Hamilton faunas in New York. The doubtful species *(Cryphaeus* cf. *boothi* var. *callites)* has an occurrence at a horizon, earlier than the Hamilton now first reported. The third *Phacops rana* is one of the very few Devonian trilobites having a wide range.

Kingsley (J. S.) The systematic position of Trilobites.

Amer. Geol., vol. 20, 1897, pp. 33-40.

The author remarks, on p. 34: "Not a single homology can be drawn with any degree of certainty between Limulus and any trilobite. The regional divisions are different; the appendages are built upon a different plan, while the larvae of the two groups present but the slightest and most superficial resemblance to each other."

Kliver (M.) Über einige neue Blattinarien, zwei Dictyoneura und zwei Arthropleura Arten aus der Saarbrücker Steinkohlenformation.

Palæontographica N. F. IX, pp. 251-265, pl. 34-36, 1883.

Arthropleura armata Jord.

Koenen (A. von). Ueber die Organisation der Trilobiten.

Marburger Sitzber, 1872, pp. 77-78.

Verhandl. d. Naturhist. Ver. d. Preuss. Rheinl. and Westphal. 29 Jhg. (3F. 9 Jhg.). 1872, pp. 93-95.

--- Ueber die Underseite der Trilobiten.

Neues Jahrb. für Mineral, Jhg., 1880, vol. 1, pp. 430-431.

Koninck (L. G.) de Description of the Palæozoic Fossils of New South Wales (Australia). Translated by Prof. T. W. Edgeworth David. Mrs. David and W. S. Dunn.

Memoirs Geol. Survey N. S. Wales Palæontology, No. 6, xii, 298 p., 24 plates, 1898.

For list of Crustacea see Mem. Sci. Liége, vol. vii, 1878; also Bibliography of the Palæozoic Crustacae, Vogdes, p. 128.

Krause (A.) Ueber die Ostrakodenfauna eines holländischen Silurgeschietes.

Zeitschr. Deutsch. Geol. Ges., vol. 48, Jahg., 1896, p. 932, plate XXV.

Isochilina cf. *canaliculata* Krause. *Primitia distans* Krause, *P.* cf. *bursa* Krause. *P. Schmidtii* Krause, *P. elongata* Krause, *P. elongata* var. *obliqua* Steusloff, *P. binodis* n. sp., *P.* cf. *canaliculata* Steusloff. *Entomis* cf. *sigma* Krause, *E.* cf. *obliqua* Krause, *E. oblonga* Steusloff, *E. imperfecta* n. sp. *Placentula Jonesii* n. sp. *Bollia minor* Krause var. *ornata* n. var. *Tetradella harpa* Krause. *Ctenobolina rostratae* Krause, *C. rostrata* var. *cornuta* n. var. *Bythocypris* cf. *symmetrica* Jones.

Krejci (J.) O trilobitech.

Ziva 11, 1854, pp. 83-89, plate 3.

Dalmanites socialis Barr. *Trinucleus ornatus, Acidaspis mira.*

Kutgen (Carl). Die Trilobiten des K. G. H. naturhistorischen Museums.

Publicat de 1, Instit. Roy. grand-ducal Luxembourg, Sec. Sci. Nat. vol. 16, 1877. pp. 127-142.

Proctus Cuvieri Steininger. *Phacops latifrons* Bronn. *Dalmanites caudata* Emm. *Homalonotus platynotus* Dalm., *H. delphinocephalus* Murch., *H. laticauda, H. Knightii* Koenig, *H. obtusus* Sandb., *H. crassicauda* Sandb. *Calymmene Blumenbachii* Brong.

Lake (Philip). On the British species of Acidaspis.

Quart. Jour. Geol. Soc. London, vol. 52, pp. 235-245, plates 7-8.

The author describes and illustrates the following species:

Acidaspis Brighti Murch., *A. coronata* Salter, *A. deflexa* n. sp., *A. crenata* Emm., *A. quinquespinosa* Salt. MS., *A. Barrandei* Fletcher & Salter non Angelin, *A. Hughesi* Salt. MS., *A. crinaceous* Marr & Nicholson, *A. calliparcos* Wyv. Thomson.

The author remarks the British species which have been described have in many cases been imperfectly figured, and the result is endless confusion.

The common English trilobite *Acidaspis coronata* has received abroad no less than three names, all of them different from ours. In England the foreign name *Acidaspis crenata* is often applied to a species which is quite distinct from the original *Acidaspis crenata.*

The author remarks in regard to the synonymy of *Acidaspis coronata* that it is known in England by the name of *A. coronata,* as *A. Marklini* in Sweden, and *A. mutica* in Germany; Murchison's term *quadrimucronatus* is older than any of them.

Even the name of the genus itself is matter of controversy. Murchison's Silurian System, p. 653, employed the term Acidaspis, and in the same year Emmrich, De Tril. Diss. inaug., p. 53, proposed the name Odontopleura. This controversy depends on the publication of Murchison's and Emmrich's terms Acidaspis and Odontopleura.

A copy of Murchison's Silurian System was presented to the Geological Society London, Jan. 9, 1839. This would indicate that the book was published early in January, 1839. Captain Portlock, in his address delivered at the 8th annual meeting, Geological Society of Dublin, Feb. 14, 1839, remarks he had been favored with a copy of the work in sheets, prior to its general publication. Jour. Geol. Soc. Dublin, vol. 2, pt. 1, 1839, p. 29.

Emmrich's paper bears the date, April, 1839.

There is, however, an earlier name still, the use of which has been advocated by Vogdes (Proc. Nat. Sci. Phila., 1877, p. 138); also afterwards by Clarke (10th Rep. N. Y. State Geologist, 1891, p. 61). This name is Ceratocephala Warder (Am. Jour. Sci., vol. 34, 1838, p. 377). Dr. Lake remarks that "even if its rival be eligible, Acidaspis has been so widely used for so long a time that here at least I do not propose to adopt any other."

LAKE (Philip)—Continued

Warder's species *Ceratocephala goniata* belongs to the same group as *Acidaspis vesiculosa* Barrande.

Beyrich's *Odontopleura Brightii* is identical with *A. quinquespinosa* Salter MS.

——— The Trilobites of the Bokkeveld Beds.

Ann. South African Mus., vol. 4, part 4, 1904, pp. 201-220, 5 plates.

Phacops pupillus n. sp., *P. arbuteus* n. sp., *P. crista-galli* Woodw., *P. africanus* Salter, *P. ocellus* n. sp., *P. impressus* n. sp., *P. (Cryphaeus) caffer* Salter. *Phacops* sp. *Dalmanites lumatus* n. sp. *Dalmanites* sp. *Proetus malacus* n. sp. *Typhoniscus Baini* Salter. *Homalonotus Herscheli* Murch., *H. quernus* n. sp., *H. colossus* n. sp. *Homalonotus* sp.

Several of these species were described by Salter, Trans. Geol. Soc., series 2, vol. vii, 1856; also by Henry Woodward, Quart. Jour. Geol. Soc., vol. xxix, 1873; and by Dr. Frech, who describes a *Homalonotus* which he believed to be new, in Lethaea Geognostica Th. 1, Bd. ii, Leif. 1, 1897, p. 218. *H. perarmatus* n. sp.

——— On Trilobites from Bolivia.

Quart. Jour. Geol. Soc. London, vol. 42, 1906, pp. 425-430, plate XL.

Peltura sp. *Symphysurus apolonista* n. sp. *Trinucleus boliviensis* n. sp. *Ogygia. Phacops* cf. *arbuteus* Lake. *Dalmanites Paituna* H. & R., *D. maccuruia* Clarke. *Dalmanites* sp.

The earlier genera show affinities with the contemperaneous European fauna.

The Devonian species are much more closely allied to those of South Africa and North America.

——— The Cambrian Trilobites.

A Monograph on the British Cambrian Trilobites. Palæontographical Society, 1906, part 1, pp. 1-28, plates 1-2.

Agnostus fissus Lundgren, *A. punctuosus* Ang. (The *Agnostus scarabaeoides* Salter, as described by Hicks, is clearly only a flattened and imperfect specimen of this species.) The *Agnostus scutalis* Hicks. Quart. Jour. Geol. Soc., vol. 28, pl. v, f. 9, is a beautiful tail of *A. punctuosus* Ang.

Agnostus Davidis Salt., *A. exaratus* Gronwall. (The *Agnostus scutalis* as described by Hicks, Quart. Jour. Geol. Soc., vol. 28, p. 175, pl. v, figs. 12 and 13, and probably figs. 11 and 14, not figs. 9 and 10, includes at least two distinct species. The descriptions of the heads corresponds with Gronwall's species, but the tail is apparently based on a specimen of *A. punctuosus.)*

Agnostus reticulatus Ang., *A. pisiformis* Linne, *A. pisiformis* var. *obesus* Belt, *A. trisectus* Salt., *A. altus* Gronwall, *A. Barrandei* Salt., *A. rotundus* Gronwall, *A. nudus* Beyr., *A. Eskriggei* Hicks, *A. Barlowi* Belt.

Section Limbati: (a) Regii *Agnostus cambrensis* Hicks. (b) Fallaces *Agnostus integer* Beyr., *A. securiger* n. sp., *A. fallax* Linnrs., *A. rudis* Salt., *A. sidenbladhi* Linnrs., *A. calvus* n. sp., *A. dux* Callaway, *A. Callavei* Raw MS., *A. cyclopyge* Tullberg, *A. obtusus* Belt.

Section Parvifrontes: *Agnostus truncatus* Brogger.

——— A Monograph of the British Trilobites.

Part 2, Palæontological Society, 1907, pp. 29-48, plates 3-4.

Agnostus incertus Brogg. *Microdiscus* Salter (non Emmons).

The genus *Microdiscus* was first established by Emmons Am. Geol., vol. 1, pt. 2, p. 116, pl. 1, fig. 8, for a small trilobite to which he gave the name of *Microdiscus quadricostatus*, which Dr. Lake refers to *Trinucleus* and takes Salter's *Microdiscus punctatus* for the type of the genus.

LAKE (Philip)—Continued

Microdiscus lobatus Hall, *M. speciosus* Ford, *M. punctatus* Salter, refers *M. scanicus* Linnrs., *M. eucentrus* Linnrs. to this species. *Microdiscus Sculptus* Hicks. *Shumardia pusilla* Sars (refers *Conophrys salopiensis* Callaway to this species). *Shumardia miqueli* Pompecki, *S. bottnica* Wiman. *(Acanthopleurella Grindroni* Groom, to this species.) *Shumardia pusilla* var. *morvensis* n. var. *Shumardia* sp. *Orometopus elatifrons* Ang. Refers this genus to the family Trinucleidæ as a primitive form. *Orometopus praenuntius* Salter (Ampyx Salter, Mem. Geol. Sur., vol. 3, p. 321, pl. 8, fig. 5).

——— A Monograph of the British Trilobites.

Part III, Palæont. Soc. London, 1908, pp. 49-64, plates V-VI.

Olenus truncatus Brünnich, *O. gibbosus* Wahl., *O. micrurus* Salt., *O. cataractes* Salt., *O. mundus* n. sp., *O. longispinus* Belt. *Parabolina Spinulosa* Wahl. *Parabolinella Williamsoni* Belt.

——— A Monograph of the British Cambrian Trilobites.

Part 4, pp. 65-88, plates vii-x, Palæontographical Society, 1912.

The author describes and illustrates *Parabolinella caesa* nov.; compares it with *P. williamsoni*, to which it is closely allied.

Parabolinella rugosa Brögger var., *P. triarthra* Callaway, described by that author under the genus Olenus in 1877.

Triarthrus shinetonensis Raw. The species named by Raw, Rep. Brit. Assoc. for 1907, p. 512, without a description or figure.

The author compares it with *T. spinosus* Billings.

Dr. Ami, Trans. Ottawa Field Nat., vol. 1, No. 4, 1882-83, indicates that *Triarthrus spinosus* Billings, had spines on the 8th to 13th segment of the thorax. The English species has 14 segments in the thorax, with the 12th axis ring spined.

Genus Sphærephthalmus Angelin.

The author remarks that the genera Leptoplastus, Sphærophthalmus, Ctenopyge and Eurycare, form a natural group of the Olenidae, characterized by the fact, that the cheek spines do not spring from the posterior angles of the head, but from the middle of the external margin or even from the lateral angles.

Brögger considers that all these forms should be placed in a single genus, which he calls Leptoplastus, divided into four subgenera.

The author describes *Sphaerophthalmus alatus* Boeck. This species is the same as *Olenus humilis* Phillips, 1848, according to Linnarsson's investigations of original specimen.

Sphaerophthalmus major nov.

Ctenopyge: The author does not agree with Brögger and Moberg that only the axial rings are fused, while the pleurae are free. The pleurae seem to be closely connected and rarely show any signs of separation.

The author describes *Ctenopyge fusiformis* nov., *C. bisulcatus* Phillips. Salter, taking *Angelin's Sph. alatus* figure as his guide, indicating it with *Olenus bisulcatus* Phillips; therefore this species in English publications means *Ctenopyge bisulcata* or some similar form. *Ctenopyge falcifera* nov., *C. pecten* Salter, *C. expansa* Salter, *C. teretifrons* Angelin, described under the generic name of Sphaerophthalmus.

Lambert (A. E.) Description of *Dalmanites lunatus*.

Bull. Geol. Soc. America, vol. 15, p. 480, plate 44, 1904.

Lapparent (A.) De Note sur un gisement de Trilobites decouvert par M. Maurice Gourdon aux environs de Luchen.

Bull. Geol. Soc. France, 3rd ser., vol. 8, 1879-1880, pp. 47-48.

Lapworth (Charles). On the discovery of the Olenellus fauna in the Lower Cambrian Rocks of Britain.

Geol. Mag. Dec. 3, vol. 5, 1888, p. 484; also p.190, vol. 6, 1889.

The author remarks: "The remarkable fauna of the Olenellus or lowest Cambrian zone originally discovered in America by Dr. Emmons in 1844 (the Taconic system based on observations in New York, Massachusetts, Maine, Vermont and Rhode Island, Albany, 1844, p. 21, *Elliptocephala asaphoides,)* was first recognized in Europe by the late Dr. Linnarsson in 1871 (Ofversigt af Kongl. Vetenskaps Akad. Forhandl, No. 3, p. 790, *Paradoxides Kjerulfi)*, in the basal zones of the Cambrian near Lake Mosen in Norway, but its typical genus Olenellus was then referred by him to the allied but more recent genus Paradoxides.

This reference was corrected by Prof. Brögger in 1875 (Geol. Förening Stockholm Förhandl., vol. 2, 1875, p. 573), and the various brilliant papers on the primoidilal formations by this author have given the Olenellus fauna a marked and peculiar interest.

In 1882 Linnarsson next made known the existence of the Olenellus fauna in Scania at the base of the Swedish Cambrian. In 1886 the same fauna was detected by Mickwitz in the Lower Cambrian of Russia (Esthonia) and this Russian fauna has been lately figured and described by Dr. Schmidt. Dr. Holm has signalized the existence of the Olenellus fauna in the Cambrian of Lapland, where it was detected by Morstell in 1885.

The original discovery of the Olenellus zone in Europe was made by Dr. A. G. Nathorst in 1868. This species, *Olenellus Kjerulfi,* was named *Paradoxides Wahlenbergi,* Torell Petrefacta Suecana from Cambrica, 1869-70, p. 4, but he did not describe or figure the new form; therefore, *O. Kjerulfi* must be retained for the name of the species.

Laurie (M.) The Embryology of the Scorpion.

Micr. Sci. Quart. Jour. ser., vol. 31, 1890, pt. 2, p. 105.

Euscorpitus italicus.

——— On some Eurypterid remains from the Silurian Rocks of Pentland Hills.

Trans. Roy. Soc. Edinb., vol. 37, 1892, p. 151.

Stylonurus ornatus nov., *S. macrophthalmus* nov. *Eurypterus Scorpiodes* Woodw., *E. conicus* nov., *E. cyclophthalmus* nov. *Drepanopterus pentlandicus.*

——— Recent additions to our knowledge of Eurypterida.

Nat. Sci., vol. 3, 1893, p. 124.

——— The Anatomy and Relations of the Eurypteridae.

Trans. Roy. Soc. Edinb., vol. 37, 1893, p. 509.

——— On some Eurypterid remains from Upper Silurian Rocks of the Pentland Hills.

This author has described in a paper before the British Association, 1892, p. 729, and the Royal Society of Edinburgh between the years 1892 and 1899, Trans, Roy. Soc. Edinb., vol. 38, pt. 1, p. 151, 1893, and vol. 39, 1890, p. 575, four new species to the genus Eurypterus, three to Stylonurus, and makes a new species of Silmonia. He is compelled to make two new genera to receive some more generalized forms. One of these, Drepanopterus, comprising three species, combines characters found in Stylonurus and Eurypterus; and for one species with very generalized characters he makes the genus Bembicosoma.

LAURIE (M.)—Continued

Stylonurus ornatus nov., *S. macrophthalmus* nov., *S. elegans, S. bembicoides. Eurypterus scorpoides* Woodw., *E. conicus* nov., *E. cyclophthalmus* nov., *E. dolichoschelus* nov., *E. minor* nov. *Drepanopterus pentlandicus* nov., *D. bembicoides, D. lobatus. Slimonia dubia* nov. *Bembicosoma pomphicus* nov.

——— On a Silurian Scorpion and some additional Eurypterid remains from the Pentland Hills.

Trans. Roy. Soc. Edinburgh, vol. 39, pt. 3, p. 575, 1899.

Clarke and Ruedemann remark on this genus that as Eusarcus and the Siluric scorpions are so much alike in their body form they may be assumed to have had similar habits.

Lee (G. W.) A Carboniferous fauna from Nowaja Semlja, collected by Dr. W. S. Bruce, with notes on Corals by R. G. Carruthers.

Trans. Roy. Soc. Edinburgh, vol. 47, pt. 1, 1909, pp. 143-186, 2 plates.

Carboniferous Ostracoda:

Phillipsia Eichwaldi ? *Leperditia okeni* Münster. *Bairdia curta* McCoy. *Cytherella* ? *inflata* Münster.

——— Note on Arctic Palæozoic fossils from the Heela and Fury collections.

Proc. Roy. Soc. Edinburgh, vol. 18, No. 4, 1912, pp. 244-264, text figs.

Ostracoda: *Leperiditia phaseolus, L.* aff. *balthica* var. *guelphica, L.* cf. *caeca.*

Leriche (Maurice). La faune du Gedinnien inferieur de l'Ardenne.

Mem. Mus. Belgique, Bruxelles, vol. 6, 1912, pp. 1-58, plates 1-3.

Ostracoda: *Beyrichia Kloedeni Primitia Jonesi. Homalonotus Roemeri* and *Acaste Downingiae.*

The author refers *H. Vialai* Gosselet, 1912, to this species.

Leyh (C. Fr.) Beiträge zur Kenntniss des Paläozoicum der Umgegend von Hof a Saale.

Zeitschr. Deutsch, Geol. Ges., 1897, Bd. 49, pp. 504-560, plates 17-18.

The author describes *Dechenella hofensis* n. sp. *Proetus angustgenatus* n. sp. *Phillipsia* cf. *aequalis* H. V. Meyer, *P. Glassi* n. sp., *P. pustulata* Schloth. *Griffithides longicornutus* n. sp., *G. articulatus* n. sp., *G. pupuloides* n. sp., *G. Moroffi* n. sp. *Phillipsia* sp.

Ostracoda: *Beyrichia* aff. *intermedia* J. & H. *Leperditia Okeni* Münst., *L. parallela* J. & K., *L. suborbiculata* Münst. *Cytherella* aff. *inflata.*

Lima (Wenceslau de). Note sur un nouvel Eurypterus du Rothliegendes de Busaco.

Comm. da Commissão des Trablhos Geol. de Portugal, Tom. 2, 1890, pp. 153-157, plate.

Lindström (G.) Förteckning pä Gotlands Siluriska Crustacéer.

Öfversigt af Kongl. Vetenskaps-Akad Forhandlingar, 1885, No. 6, pp. 37-100, plates 12-16.

Reviewed Geol. Mag., Dec. 3, vol. 3, 1886, p. 33.

The author describes under Phacops subgenus Dalmanites:

Phacops vulgaris Salt., *P. imbricatula* Ang., *P. obtusa* nov. Subgenus Phacops. *Phacops Downingiae* Murch., *P. quadrilineata* Ang., *P. Musheni* Salt. *Chirurus speciosus* His., *C. conformis* Ang., *C. bimucronatus* Murch. *C. gotlandicus* nov. *Sphaerexochus*

LINDSTROM (G.)--Continued

scarbridus Ang., *S. latifrons* Ang., *S. lacinatus* nov., *S. Beyrichi* nov. Youngia new genus genotype *Cheirurus trispinous* Etheridge and Nicholson.

Cephalon semi-circular with long spines to the genal angles; glabella sub-circular convex truncated posteriorly by occipital furrow overhanging front 3 pairs of lateral furrows to the glabella; occipital ring with long spine; fixed cheeks, small, short, narrow. Pygidium not known.

The author describes as new *Youngia globiceps* and *Y. inermis Deiphon Forbesi* Barr. *Encrinurus punctatus* Wahlen., *E. laevis* Ang., *E. obtusus* Ang. *Acidaspis crenata* Emm., *A. Barrandei* Ang., *A. Marklini* Ang., *A. pectinata* Ang., *A. (Trapelocera) bicuspis* Anglin. *Lichas concinnus* Ang., *L. latifrons* Ang., *L. palifer* nov., *L. araneus* nov., *L. ornatus, L. marginatus* nov., *L. visbyensis* nov., *L. plicatus* nov., *L. triquetrus* nov., *L. rotundifrons* Ang., *L. gotlandicus* Ang. *Trochurus Salteri* Fletcher.

The generic name of Trochurus was used by Beyrich Böhm, Tril., 1845, p. 31, for a composite and artificial species consisting of the head of *Staurocephalus Murchisoni* and the tail of *Lichas palmata* Barr., which the author recognized in the Untersuch uber Tril., 1846, p. 10, and declared that the genus did not exist. The name was revived by Lindström in a wider and slightly different sense, giving *Lichas Salteri* as the type, including *Trochurus pusillus* Ang. *Harpes acuminatus* nov.

Calymmene tuberculata Brunnich, C. spectablis Ang., C. laevis nov., preoccupied by Munster of a species of Calymmene which is now referred to Phacops *(C. Lindströmi* nov.*) Calymmene frontosa* nov., *C. intermedia* nov., *C. excavata* nov., *C. papillata* nov. *Homalonotus Knighti* König. *Phaetonides Stokesi* Murch., *P. rugulosus* nov., *P. longifrons* nov. *Cyphaspis elegantula* Ang., *C. punctillosa* nov. *Proetus concinnus* Dalm., *P. obconicus* nov., *P. distans* nov., *P. acutus* nov., *P. conspersus* Ang., *P. signatus* nov., *P. granulatus* nov., *P. verrucosus* nov. *Illaenus* subgen. *Bumastus barriensis* Murch., *B. Holmi* nov., *B. sulcatus* nov. for *Illaenus insignis* Holm. *Bronteus platyactin* Ang., *B. Marklini* Ang., *B. polyactin* Ang., *B. irrandians* nov., *B. umbonatus* nov., *B. crebristriatus* nov.

Merostomer: *Eurypterus Fischeri* Eichw. *Pterygotus osiliensis* Schm.

——— Ueber die Schichtenfolge des Silur des Insel Gotland.

Neues Jahrb. Min. Geol. Pal., Bd. 1, 1888, pp. 147-164.

——— Researches on the visual organs of the Trilobites.

Kongl. Svenska Vetenskaps Akad. Handlingar Bandet 34, No. 8, 1901.

Dr. Lindstrom considers certain nodes on the hypostoma to be visual organs. This is based on the discovery of Dr. Liljevall from the hypostoma of *Bronteus polyactin* Ang. They are located on the inferior edge of the upper groove, close to the lateral margins. To these tubercles he gives the name of "maculae". They are oblong or ellipsoid; their inferior apices bluntly pointed or rounded, two-thirds of their surface is perfectly smooth or glossy, and the lower one-third covered with a compact accumulation of small granules, similar to the facets of the compound eyes of Trilobites. The author, therefore, assumes that they are a pair of small adventive eyes on the exterior side of the hypostoma, from the perfect structural agreement between them and the eyes of the head. The author sums up the literature on blind trilobites without facial ridge; also those with facial ridge, and illustrates the maculae on the hypostoma of 39 genera and 136 species.

The different genera are divided into six groups as follows:

Group 1—In the sectioned maculae there is no tract of any structure. The test of the maculae considerably thinner than that of the hypostoma. According to the affinites of the genera they may be subdivided as follows. a—*Bumastus, Dysplanus*, b—

LINDSTROM (G.)—Continued

Nileus, Symphysurus,? Ogygia. c—*Calymmene, Homalonotus.* d—*Cheirurus* pro parte.

Group 2—The whole maculae is of a spongious or irregularly polyhedric structure showing prisms in vertical sections. *Asaphus, Isotelus, Megalaspis, Ptychopyge, Niobe? Megalaspides? Barrandia, Illaenus Lichas, Trochurus? Platymetopus Encrinurus* also probably belongs to this group.

Group 3—Maculae with well-developed globular lens on the interior third of the maculae; the blank part of the maculae without any structure. In such species as *Cheirurus spinulosus* the whole maculae covered with lenses. *Bronteus, Cheirurus spinulosus.*

Group 4—The maculae form sunk pits, with smooth bottom. Structure unknown. *Dalmanites.*

Group 5—The elongate, straight maculae, carrying on their innermost point from 3 to 5 diminutive segregate ocelli, situated on a clear, white patch. *Proetus.* These ocelli have not been observed on the related genera Cyphaspis, *Phaetonides, Phillipsia* and *Griffithides,* but they may be preliminarly ranked here in consequence of their close conformity.

Group 6—The maculae have in this group been reduced to a pair of tiny ocelli, situated high up on the hypostoma, near its anterior margin. *Phacops, Acaste.*

Loomis (F. B.) The dwarf fauna of the pyrite layer at the horizon of the Tully limestone in Western New York.

Bull. New York Mus., No. 69, pp. 892-920, plates iv, 1903.

Cryphaeus Boothi var. *callitelcs* Greene, *Beyrichia dagon* Clarke. *Entomis prosenhina* n. sp.

Lorenz (Th.) Beiträge zur Geologie und Palæontologie von Ostasien unter besonderer Berücksischtigung der Provinz Schantung, in China. 2 Palaeontologischer Teil.

Zeitschrift der Deutsch. Geol. Ges., 1906, pp. 67-122, with 3 plates and 55 figures in text.

The author attaches classificatory importance to the minute structure and superficial ornamentation of the test, which has led him to change the generic allocation of many well known species, and to institute many new genera.

Lorenz, on account of the different structure or ornamentation of the test, divides the group Conocephalites into two genera: Conocephalina and Concephalites, but the type *C. Emmrichi* Barr. of the latter he puts into the former, thereby making needless confusion. Conocephalina Brögger has as its type *C. ornata* Brögger, and the author has referred to it several English species placed by Salter in Conocephalites, such as *C. invita.*

The author illustrates *Ptychoparia striata* Em. and places the genus Solenopleura as a synonym to Ptychoparia, figuring *Solenopleura brachymetopus* Angelin.

The author remarks in regard to the new genus Lioparia, that it has medium-sized eyes, in common with both Ptychoparia and Liostracus; likewise the deep dorsal furrow of Ptychoparia. In relation to the shell structure and the flat selvage, it is on the side of Liostracus. On careful consideration one must admit that Liostracus is in closer relation to the species Lioparia, than that of the genus Ptychoparia.

He refers *Conocephalites minutus* Hall to the genus, and uses *Lioparia latelimbatum* Dames, with one new species, *L. blautoeides,* as the type of the genus.

Trachyostracus new genus: Is distinguished by medium-sized wide-apart eyes, flat selvage and little or no dorsal furrows. In its outer form it is not to be distinguished from Liostracus. The difference in the genera lies alone in the different shell struc-

LORENZ (Th.)—Continued

ture. Trachyostracus has a thick, rough shell; Liostracus a smooth, finely porous shell. These two genera exhibit a rare case of convergence.

Examples of this species are the two following forms: *Solenopleura Howleyi* Walc. and *Ptychoparia limbata* Matt.

Under Liostracus Angelin, as emend. by Brögger, the author includes *Liostracus microphthalmus* Ang., fig. 4. *Ptychoparia Piochensis* Walcott. *Anomocare planum* Dames. *Liostracus Linnarssoni* Brögger, *L. aculeatus* Ang.

Macrotoxus n. gen.: The principal characteristics consist in the very long arch-shaped eyes, the deep dorsal furrows and the thick, rough shell. The author refers *Anomocare Angelini* Grönwall and *Conocephalites perseus* Hall to the genus.

Alokistocare new genus: This genus has in common with Macrotoxus the long, arch-shaped eyes, and the long dorsal furrow around the glabella. By its porous shell it is differentiated from the former. The author refers *Ptychoparia subcornata* H. & W. to this genus.

Megalophthalmus new genus: Also here are the long, arch-shaped eyes the principal element. The glabella does not lie deeply in the head shield, but comes out high over the cheeks. Even trace of dorsal furrows is lacking. The shell is thick, rough, not porous.

The author refers *Liostracus megalurus* Dames and *Anomocare minus* Dames to this new genus, remarking that it is not improbable that this group is also distributed in North America. In its external appearance it resembles throughout the old Swedish species of Anomocare. The last, however, has a highly porous shell.

Under the genus Anomocare the author includes *Anomocare latelimbatum* Dames, *A. excavatum* Ang., *A. limbatum* Ang. *Liostracus Maydelli* Schmidt, *Anomocare commune* n. sp. and *A. laeve* Ang.

The author places Conocephalina Brögger and Conocephalites Barrande, under two groups, on the difference of the ornamentation of the test, using *Ptychoparia Emmrichi* for the type of the first genus, with granulated shell; and *Concephalites ornatus* Brögger for the second genus, although Brögger used this for his type.

The author figures *Ptychoparia Emmrichi* Barr. also *Conocephalites ornatus* Brögger and *C. suecicus* Wallerius.

The author gives the following description of the new genus *Amphoton* with the species *A. Steinnanni* for its type:

Glabella narrow, highly cylindrical, with deep furrows. On both sides of the high glabella wing-shaped, similuna-shaped cushions, that resemble ears on a great elephant head. The eyes are long, box-shaped and stand upright. The anterior eye corners lie close to the glabella. The facial sutures follow the eye lobes, diverging slightly from the anterior eye corners to the frontal margin. From the rear eye corners it branched outwardly into a horizontal piece before it cuts through the rear margin; thereby forms a small band attached to the rear of the cheek. Close to the front end of the glabella is a narrow, flat, bent-up edge. The pygidium greatly resembles that of Anomocare, for in a slab of fossils from Laiwa, are found numerous head shields of this species, corresponding to head and tail shields of Anomocare.

On page 91, the author describes *Anomocare commune* n. sp. (referred by Walcott to *Anomocarella chinensis* Walcott); also *Anomocare ovatum* n. sp. and *A. speciosum* n. sp. (referred by Walcott to the genus Anomocarella).

The author includes a description of Olenus sp. Ptychoparia (Solenopleura) sp., and the description of a new genus Schantungia, with *S. Buchruckeri* for its type (this has been referred by Walcott to *Chuangia nitida).*

The other fossil crustacea described in this work are: *Schantungi Monkei* n. sp. *Liostracus latus* n. sp. *Agnostus fallax* Linrs. var. *Laiwuensis* n. var., *A. parvifrons*

LORENZ (Th.)—Continued

Linrs. var. *latelimbatus* n. var. *Asaphus Boehmi* n. sp. *Lioparia latelimbata* Dames (*Anomocare latelimbatum* Dames) *Teiniston* sp. *Drepanura* sp. and hypostoma of Anomocare.

Lucas (H.) Otarion et Paradoxide.

Articles du Dictionaire Universal d'Hist. Nat., dirigé par Ch. d'Orbigny, 1847.

Macconochie (A.) Discovery of Organic remains in the Old Red Sandstone of Lorne.

Summary of Progress for 1897, Mem. Geol. Sur. of Great Britain, pp. 82-83.

Macnair (P.) The geology of the Rouken Glen and its neighbourhood.

Glasgow Trans. Geol. Soc. 12, 1906, pp. 362-397, pl. ix-x.

Mailleux (Eugene). Quelques mots sur les Trilobites du Couvinien des environs de Couvin.

Bull. de la Soc. Belge de Geol., vol. 17, 1904, pp. 579-585.

The author describes a new species of *Proetus Barroisi* with figures; also gives a list of species occurring near Couvin.

Mansfield (J. F.) Note on Eurypterus from the Darlington Shales, Penn.

Am. Philos. Soc. Proc., vol. 19, 1881, p. 352.

This species is classified by Clarke and Ruedemann under the subgenus Anthraconectes.

Mansuy (H.) Etude géologique du Yun Nan oriental IIe partie Palaeontolog.

Mem. service geol. l'Indo-Chine, vol. 1, 1912, pp. 1-146, pl. 1-25.

The author describes the following crustacae:

Ostracods: *Bradoria douvilleri* Mansuy. Aluta sp. Nothozoe.

Trilobites: *Redlichia chinensis* Walc., *R. nobilis* Walc., *R. Walcotti* Mansuy, *R. carinata* Mansuy, *R.* sp. *Palaeolenus douvilleri* n. sp. and gen., *P. lantenoisi* Mansuy, *P. deprati* Mansuy, *Ptychoparia yunnanensis* Mansuy. The new genus Palaeolinus is allied to Agraulos.

Matthew (G. F.) Traces of the Ordovician on the Atlantic coast.

Trans. Royal Soc. Canada, vol. 1, 1893, p. 253.

Holasaphus centropyge n. gen. et sp.

—— Organic remains of the Little River Group, No. IV.

Trans. Royal Soc. Canada, vol. 1, section iv, 1895, pp. 273-279, plate.

Amphipeltis paradoxus, Salter.

——— The Protolenus Fauna.

Trans. New York Acad. Sci., vol. 14, 1895, pp. 101-153, plates.

Ostracoda: *Hipponicharion eos* Matth., *H. cavatum* Matth., *H. minus* Matth. *Beyrichona papilio* Matth., *B. tinea* Matth., *B. planata* n. sp., *B. triangula* n. sp., *B. ovata* n. sp., *B. rotundata* n. sp. *Aparchites secunda* n. sp., *Primitia aurora* Matth., *P. oculata* n. sp., *P. ? fusiformis* n. sp. *Schmidtella cambrica* n. sp. *Leperditia ? ventricosa* Matth., *L. ? Steadi* Matth., *L. ? minor* n. sp., *L. ? primeava* n. sp.

Phyllopoda: *Leperditia sigillata,* Matth.

MATTHEW (G. F.)—Continued

Trilobita: *Protagraulos priscus* n. sp. *Ellipsocephalus galeatus* Matth., *E. grandis* Matth., *E.* sp. *Avalonia acadica* n. sp *Micmacca Matthewi* n. gen. et sp., *M. Van Ingeni* n. sp., *M. recurva* n. sp., *M. ? plana* n. sp. *Protolenus paradoxides* Matth., *P. bi-tuberculatus* n. sp. *Bergeronia n.* subgen., *B. elegans* W. D. Matthew, *B. articephala* Matth.

——— Fauna of the Paradoxides beds in Eastern North America.

Trans. New York Acad. Sci., vol. 15, 1896, pp. 191-247, plates.

Phyllopoda: *Leperditia alata* Matth., *L. curta* Matth., *L. auriculata* Matth.

Ostracoda: *Primitia acadica* Matth. *Aluta flexilis* n. gen. et sp.

Cirripedia: *Plumulites Manuelensis* n. sp. *Stenotheca concentrica Matth.* and var. *radiata, S. triangularis* Matth., *S. nasuta* Matth., *S. Hicksiana* Matth. *Cirripodites cambrensis* n. gen. et sp.

Trilobita: *Agnostus regulus* Matth., *A. rex* Barr. var. *transectus* n. var, *A. fallax* Linrs.; also var. *vir* n. var. *concinnus* n. var. and *trilobatus* n. var., *A. Acadicus* Hartt var. *declivis* n. var., *A. parvifrons* Linrs. var. *tessella* n. var. *truncatus* n. var., *A. umbo* Matth., *A. obtusilobus* Matth., *A. Davidis* Salt., *A. gibbus* Linrs. var. *partitus* n. var. *acutilobus* n. var., *A. Nathorsti* Br. *confluens* n. var., *A. fissus* Lund. *trifissus* n. var. *A. punctuosus* Ang., *A. laevigatus* Dalm., *A. terranovicus* n. var. *ciceroides* n. var., *A. mamilla* n. var., *A. nudus* Beyr. *Microdiscus Schucherti* Matth., *M. precursor* Matth., *M. Dawsoni* Hartt, *M. pulchellus* Hartt, *M. punctatus* Salter.

——— On *Microdiscus*.

Amer. Geologist, vol. 18, 1896, p. 30.

Microdiscus Schucherti n. sp.

— - - Studies on Cambrian Faunas (No. 1).

Trans. Royal Soc. Canada, vol. 3, Sec. iv, 1897, pp. 165-203, 4 plates.

Agnostus Nathorsti Br., *A. fissus* Lund., *A. punctuosus* Ang., *A. parvifrons* Linrs. cf. var. *nepos* Br., *A. umbo* Matth., *A. laevigatus* Dalm. *Microdiscus pulchellus* Hartt? *Conocoryphe pustulosa* n. sp.

Matthews in his division of this genus, Studies on Cambrian Faunas No. 3, p. 89, uses for dwarf species with large glabella and apical spine to the front margin, suture within the rim, the term *Cainatops*, with this species as the type.

Paradoxides abenacus Matth. *Agraulos ceticephalus* Barr. var. *carinatus* n. var., *A. holocephalus* Matth., *A. Roberti* n. sp., *A. ? nanus* n. sp., *A. pusillus* n. sp. *Liostracus validus* n. sp. *Ptychoparia limbata* n. sp., *P. Adamsi* Bill. *Solenopleura arenosa* Bill. var. *angilimbata* n. var., *S. Robbii* mut. *parva. Anomocare magnum* Br. *Dolichometopus Acadicus* n. sp. *Dorypyge Wasatchensis* H. & W., also var. *Acadicus* n. var., *D. quadriceps* H. & W. var. *valida* n. var., *D. horrida* n. sp.

Billing's Primordial Fossils of Vermont and Labrador.

Trans. Royal Soc. Canada, vol. 3, Sec. iv, 1897, pp. 194-200.

Bathyuriscus Meek, *B. senectus* Bill. *Dorypyge parvula* Bill. *Anomocare Tucer* Bill. *Ptychoparia Adamsi* Bill. *Solenopleura arenosa* Bill. *Conocephalites miser* Bill. *Dorypyge parvula* Bill. var. *angifrons* n. var.

——— What is the Olenellus fauna?

Am. Geol., vol. 18, 1897, p. 396.

Proposes the subgenus Callavia type *O. Bröggeri* Walc. and *O. callavii* Lapworth, because the glabella differs from *O. Kjerulfi*.

——— Some characteristic genera of the Cambrian.

Address Brit. Assoc., 1897, Geol. Mag. London, Decade iv, vol. 5, 1898, pp. 82-83.

The specie and genera have been described in other papers by this author.

MATTHEW (G. F.)—Continued

——— Recent discoveries in the St. John Group, No. 2.

Bull. Nat. Hist. Soc., New Brunswick, No. xvi, 1898, pp. 32-34, plate.

Protolenus elegans n. sp., *P. paradoxoides* n. sp., *P. articephalus* n. sp., *Ellipocephalus galeatus* n. sp. *Olenus Zoppii* Menigh.

——— Studies on Cambrian faunas, No. 2.

Trans. Royal Soc. Canada, vol. 4, Sec. iv, 1898, pp. 123-150, 2 plates.

Ostracoda: *Primitia pyriforms* n. sp. *Aparchites ? robustus* n. sp. *Beyrichia ? primaeva* n. sp.

Trilobita: *Protagraulos priscus* Matth. *Micmacca Van Ingeni* Matth. *Agnostus pisiformis* with variations. *Anomocare stenotoides* Matth. *Olenus* (subgen. *Acantholenus)* n. subgen. *Acantholenus spinger* Matth.

——— A new Cambrian Trilobite.

Bull. Soc. N. B., vol. 4, 1899, pp. 137-142, plate.

Metadoxides magniferus n. sp.

——— Studies on Cambrian faunas, No. 3. Upper Cambrian fauna of Mount Stephen, B. C.

Trans. Royal Soc. Canada, vol. 5, Sec. iv, 1899, pp. 39-66, 7 plates.

Agnostus montis n. sp. *Ptychoparia cordillerae* Roem. *Conocephalites (Conaspis?)* cf. *perseus* Hall. *Corynexochus Roemingeri* Matth. *Dolichometopus occidentalis* n. sp. *Bathyuriscus Howelli* Walc., *B. pupa* n. sp. *Neolenus serratus* n. gen. et sp., *N. granulatus* n. sp. *Dorypyge Dawsoni* Walc. *Zacanthoides spinosus* Walc. *Ogygia (Ogygopsis) Klotzi* Roem. *Oryctocephalus Walkeri* n. sp.

——— Studies on Cambrian faunas, No. 4. Fragments of the Cambrian faunas of Newfoundland.

Trans. Royal Soc. Canada, vol. 5, Sec. iv, 1899, pp. 67-96.

Microdoscus bellimarginatus S. & F. *Agraulos (Strenuella) strenua* Bill. mut. *robusta* n. mut., *S. Attleborensis* S. & F. mut. *vigilans* n. mut. *Micmacca Walcotti* n. sp., *M. angimargo* n. sp. *Avalonia plana* n. sp., *Protolenus Howleyi* Walc. *Metadoxides magnificus* Matth. *Atops trilineatus* Emm. *Erinnys breviceps* Angelin.

——— The Etcheminian fauna of Smith Sound, Newfoundland.

Trans. Royal Soc. Canada, vol. 5, Sec. iv, 1899, pp. 97-119, plates.

Aptychopsis terranovicus Matth. mut. *arcuta.*

——— Preliminary notice of the Etcheminian fauna of Newfoundland.

Bull. Nat. Hist. New Brunswick, No. 18, vol. 4, 1899, Article 1, pp. 189-197, plate 1-3.

Aptychopsis terranovicus.

——— Preliminary notice of the Etcheminian fauna of Cape Breton.

Bull. Nat. Hist. New Brunswick, No. 18, vol. 4, 1899, Art. 2, pp. 198-208, plates 1-4.

Bradoria n. gen., *B. scrutator* n. sp., *B. vigilans* n. sp., *B. rugulosa* n. sp. *Schmidtella ? pervetus* n. sp., *S. acuta* nov.

The peculiarities of this fauna as distinguished from the Cambrian are the following: 1—Great preponderance of Hyolithidae. 2—Absence or rarity of Trilobites. 3—Minuteness of the Gasteropods, except Capulidae. 4—Minuteness of the Brachiopods. 5—Minuteness of the Crustaceans.

——— Cambrian rocks and fossils of Cape Breton.

Geol. Sur. Canada, n. ser., vol. 14, 1901, pp. 223-224.

Gives the leading genera of the several groups.

MATTHEW (G. F.)—Continued

——— Additional notes on the Cambrian rocks of Cape Breton.

Bull. Nat. Hist. Soc. New Brunswick, No. 20, vol. 4, 1902.

Parabolinella quadrata n. sp. *Triarthrus belli* n. sp. *Angelina?* sp. *Asaphellus Homfrayi* var. a, *A.? planus.*

——— Ostracoda of the basil Cambrian rocks in Cape Breton.

Canadian Record of Science, vol. 8, No. 7, 1902, pp. 437-468, 2 p. with 2 plates.

Leperditia rugosa n. sp. *Bradorona n.* sub. gen., *B. perspicator* n. sp. mutation *maxima, magna, major, B. spectator* n. sp., also var. *acuta,* mutation *spinosa, aequata, B. observator* n. sp. and var. *benepuncta, laevis, ligata. Bradoria scrutator* Matth., *B. vigilans* Matth. mut. *obesa, B. rugulosa* Matth., *B.? ornata* n. sp. *Escasona* n. gen., *E. rutellum* n. sp., *E.? vetus* n. sp., *E.? ingens* n. sp. *Indiana* n. gen., *I. ovalis* n. sp. mut. *prima, I. lippa* n. sp. *Schmidtella? pervetus* Matth. mut. *concinna, S. acuta* Matth.

The author remarks that the *Bradoria* do not have the medium pit or sulcus of *Primitia,* the shallow median depression of *Primitella,* or the smooth valve of the *Aparchites.* Their most marked character is a prominence or tubercle just at the front of the hinge line.

——— Report on the Cambrian rocks of Cape Breton.

Geol. Survey of Canada, 1903, 246 pp., 18 plates.

Ostracoda of the basal Cambrian rocks in Cape Breton:

Leperdita? rugosa Matth. *Bradorona perspicator* Matth. mutations *maxima, magna, Major B. spectator* Matth. mutations *acuta, spinosa, aequata B. observator* Matth. also var. *benepuncta* mutations *laevis, ligata. Bradoria scrutator* Matth., *B. vigilans* Matth. *obesa, B. ruglosa* Matth., *B.? ornata* Matth. *Escasona rutellum* Matth., *E.? vetus* Matth., *E.? ingens* Matth. *Indiana ovalis* Matth. mutation *prima, I. lippa* Matth. *Schmidtella? pervetus* Matth. mutation *concinna, S.? acuta* Matth.

Trilobita: *Holasaphus centropyge* Matth. Paradoxidoid trilobite. *Solenopleura Bretonensis* n. sp. Eurypteroid crustacean?

Faunas of the St. John terrane.

Ostracoda: *Beyrichia triceps* n. sp.

Trilobita: *Agnostus trisectus* Salt. mut. *ponepunctus* Matth. mut. *germanus, A.* cf. *cyclopyge* Tullb., *A.* cf. var. *declivis* Matth. *Parabolina Dawsoni* Matth., *P.? quadrata* Matth., *P.* cf. *limitis,* Br. *Spaerophthalmus Fletcheri* Matth., *S. alatus* Boeck. *Ctenopyge pecten* Salt. *Peltura scarabaeoides* Wahl. *Triarthrus Belli* Matth. *Angelina? Asaphellus Homfrayi* Salt., *A.? planus* Matth.

—— Remarkable forms of the Little River Group.

Trans. Roy. Soc. Canada, ser. 3, vol. 3, 1909, Sec. iv, pp. 115-125, plates 1-4.

Leaia silurica n. sp.

This species is allied to *L. Leidyi* of the Coal Measures of Pennsylvania, but has fewer concentric ridges.

Belinuropsis Wigudensis n. sp. et gen.

This crustacean is of the general type of Belinurus, but differs in its peculiar notched posterior border, the intergenal spine or flap, and the very narrow axis to the thorax, with seven instead of five segments as in Belinurus.

Maurer (F.) Nathrage zur Fauna und Stratigraphie der Orthocerasschiefer der Rupbachthales.

Neues Jahrb. für Mineral Geol. Beil., vol. 10, pp. 613-756, plates.

Phacops fecundus Barr. *Cryphaeus acutifrons* Schluter. *Acidaspis pigra* Barr. *Bronteus* sp. and *Leperditia rhenana* n. sp.

— —— Der Quartzit von Neuweilnau.

Ber. d. Senckenb. Naturf. Ges. in Frankfurt, 1902, pp. 27-82, plates 3-5.

Gives figures of the head and tail of Homalonotus striatus nov. Head of H. ornatus Koch and tail of Homalonotus nulticostatus Koch.

McCoy (F.) Note on a new Australian Pterygotus.

Geol. Mag., Decade iv, vol. 6, 1899, pp. 193-194.

Pterygotus australis n. sp.

The species resembles *Pterygotus bilobus* Salter.

Meyer von (H.) *Jonotus reflexus* ein Trilobit aus der Grauwacke der Eifel.

Dunker and Meyer Palæontologica, vol. 1, p. 182, pl. 26, fig. 1a-b, 1848.

This new generic name given for *Harpes' reflexus,* Hoeninghaus, 1847. Dr. Von Meyer copies Hoeninghaus' figures.

Michleborough (John). Locomotory appendages of Trilobites.

Geol. Mag., Decade 3, vol. 1, 1884, pp. 80-84, woodcuts on p. 162, figs. 1-3.

Asaphus megistos.

Miller (S. A.) and **Gurley** (W. F. E.) New species of Echinodermata and a new Crustacean from the Palæozoic Rocks.

Illinois State Museum Bull. No. 10, 1896.

The authors describe *Eurypterus kokomoensis* n. sp.

Clarke & Ruedemann Mem. N. Y. State Mus., No. 14, p. 212, place this under a new subgenus Onychopterus.

Moberg (J. C.) Anteckningar om Olands orthocerkalk.

Sver. Geol. Under. Ser. C, No. 109, 1890.

Asaphus platyurus maximus n. var.

——— Om en afdelning inom Olands dictyonemaskiffer säsom motsvarighet till ceratopygeskiffern i Norge.

Sver. Geol. Under. Ser. C, No. 109, 1890.

Shumardia pusilla Sars.

—— Om den af Trinucleus coscinorrhinus Karakteriserade kalken geologiska älder.

Sver. Geol. Unders., Ser. C, No. 125, Geol. Foren. Forh., 14-5, 1892.

Nileus armadillo var. *cornutus* n. var.

——— Till fragan om pygidiets byggnad hos *Ctenopyge pecten* Salter.

Geol. Fören. Förhandl, vol. 14, 1892, pp. 351-355, figures.

— Silurisk Posidonomyaskiffer en egendomlig utbildning af Skänes oversilur med I tafla.

Sver. Geol. Unders., ser. C, No. 156, 1895.

Eoconchoecia n. gen., *E. mucronata* n. sp., *E. ? imbecils* n. sp. *Cypridina Tosterupi* n. sp., *C. ? obtusa* n. sp., *Colpos insignis* n. sp. et gen. *Primitia mundula* Jones var. *Beyrichia Steusloffi* Krausi, *B. Salterina* Jones.

MOBERG (J. C.)—Continued

——— Supplement till Om Acerocarezonen.

Geol. Fören. i Stockholm Förh., Bd. 20, No. 5, 1898.

Acerocare claudican n. sp., figured.

——— - En trilobit från Skånes Dictyograptusskiffer.

Geol. Fören. Förh., Bd. 20, No. 6, 1898, plate XVII, pp. 317-324.

Hysterolenus Tornquisti n. sp. et gen.

——— - En trilobit fran Skanes Dictyograptusskiffer Meddel, No. 5.

Fr. L. G. F. Geol. Fören., i Sthlm. Förh., Bd. 20, 1898.

Shumardia oelandica n. sp., p. 357, pl. 14, figs. 4-6.

Hysterolinus Tornquisti n. sp., p. 318, pl. 17, figs. 1-9.

——-Sveriges älasta kända Trilobiter.

Geol. Fören. Förhandl., vol. 21, 1899, pp. 309-348, plates 13-15.

Georgiellus (Elliptocephala) asaphoides Emmons. *Olenellus Thompsoni* Hall. *Holmia Kjerulfi* Linrs. *Holmia Lundgreni* Moberg. *Mesonacis Vermontana* Hall. *Schmidtia Mickwitzi* Schmidt. *Schmidtia ? Torelli* Moberg. *Olenelloides armatus* Peach.

The original discovery of the Olenellus zone in Europe was made by Dr. A. G. Nathorst in 1868, Öfvers Kongl Vetens. Akad Förhandl, 1869, p. 64, in which he described a new and distinct horizon below the Paradoxides beds at Andrarum, Scania, containing trails and Lingula. The species now known as Olenellus Kjerulfi Linrs. was named Paradoxides Wahlenbergi by Torell in his Petrefacta Suecana Formationis Cambricae, 1869-70, p. 4, but he did not describe or figure the new species.

- - - - Nya bidrag till utredning af frägan om gränsen mellan undersilur och kambrium.

Geol. Fören. i Stockholm Förh., Bd. 22, 1900.

Dicellocephalina dicracura Ang. *Shumardia oelandica* Mbg.

——— Bidrag till kännedomen om Trilobiternas byggnad.

Fören. Förhandl, vol. 24, 1902, pp. 295-302, plate 3.

Nileus armadillo Dalm.

From an example of *Nileus armadillo* Moberg shows the point of attachment of the muscles of the antennae, hypostoma epistome and several limbs of his species; eyes with 3,000 to 4,000 facets. He takes exception to Lindström, that the maculæ on the hypostome carry organs of vision and that of the earlier Olenidæ were blind.

——— *Schmaleuscia Amphionura* en ny Trilobit typ Meddelanden.

Lund. Geol. Mineral Inst., No. 5, Stockholm, 1903.

——— Om Robergia microphthalma Lnrs.

Geol. Fören. Förhandl., Bd. 28, Haft 2, p. 83, 1907.

——— Ett par bidrag till kännedomen om Skånes dicellograptus skiffer.

Geol. Fören. Förhandl., Bd. 29, Häft 2, Feb., 1907. p. 75.

Robergia microphthalma Linrs.

This new genus was founded on *Remopleurides microphthalmus* Linrs.

Geol. Fören. Förhandl., 1875, No. 26, Bd. 2, No. 12, p. 494, pl. 1, f. 3.

——— Om ett gätfullt fossil från Sveriges olenidskiffer samt en kort ofversigt af viktigase data rorande trilobiternas ventrala skelettdelar.

Geol. Fören. i Stockholm Förh., Bd., 29, 1907, No. 5.

MOBERG (J. C.)—Continued

——— *Aeglina umbonata* Angelin.

Lund's Geologiska Fältkubb., No. 12, 1907, Bd. 29, pp. 257-264, pl. 3.

The author refers *Corynexochus ? umbonatus* Ang. Palæont. Scand., p. 60, pl. 33, fig. 10, to this species; also *Æglina rediviva* Barrande. Syst. silur. Bohm, vol. 1, Suppl., p. 64, pl. 14, fig. 11.

——— Historical Stratigraphical Review of the Silurian of Sweden.

Sveriges Geol. Undersöknung, Sec. C, Nos. 229-202, pp. and map.

——— and **Gronwall** (K. A.) Om Fyledalens Gottlandium.

Lund Geologiska Fältkubb, Ser. B, No. 3, 1909, 84 pp., with 6 plates.

The authors describe and illustrate the following fossil Crustacea: *Leperditia inaequalis* Grönw. referring to it the following species: *L. Angelini* (Fr. Schmidt).

Lundgren Lund's Univ. Arsskr., Bd. 10, p. 9.

L. tyraica (Fr. Schmidt) Linnarsson, *L. phoseolus* (Hisinger).

Schmidt Misc. Silurica, No. 3, p. 9, as syn.

Aparchites obsoletus Jones and Holl. *Primitia mundula* Jones.

Beyrichia Buchiana Jones, *B. cuspidata* Gronw., *B. Kochi.* Boll; *B. Maccoyiana* Jones, referring *B. cincta* and *B. elegans* Boll, 1862, to this species.

Beyrichia nodulosa Boll, referring *B. spinulosa* and *nodulosa* Boll; also *B. dubia* Reuter, 1885, and *B. Lindstromi* cum var. *expansa* Kiesow, 1888, as syn. to the species.

Beyrichia obsoleta Gronw., 1897, *B. Salteriana* Jones, *B. scanensis* Kolmodin, referring *Beyrichia hians* Boll, 1856, to this species. *Beyrichia Steusloffi* Krause, 1891. *Kloedenia Kiesowi* Krause. This is the unnamed sp. of Angelin's, pl. A, figs. 16 and 17.

Beyrichia Wilckensiana Jones and var. *plicata* Jones. *Thlipsura tetragona* Krause, 1891. *Cytherellina siliqua* Jones. *Bythocypris triangularis* Gronw., 1897. *Phacops Downingiae* Murch. *Calymmene intermedia Lindstr.*, 1885. *Homalonotus Knighti* var. *rhinotropis* Ang. *Ceratiocaris* sp. and *Pterygotus* sp.

——— and **Moller** (H.) Om Acerocarezonen ett bidrag till Kännedomen om Skånes olenidskiffrar.

Geol. Fören. Förhandl., vol. 20, 1898, pp. 197-290, plates 10-14.

Acerocare ecorne Ang., *A. micropygum* Linrs., *A. granulatum* n. sp., *A. paradoxum* n. sp., *A. Tulbergi* n. sp., *A. claudicans* n. sp. *Paraholina acanthura* Ang., *P. heres* Br., *P. megalops* n. sp. *Acerocare norvegium* n. sp.

——— and **Segerberg** (Carl O.) Bidrag till Kännedomen om Ceratopygeregionen med särskild hänsyn till dess utveckling i Fogelsäng strakten.

Kongl. Fysiogr. Sällsk. Handl., Bd. 17, No. 7, 1906.

Crustacea: *Eremos bryograptorum* Wgd., mscr. n. gen. et n. sp. *Primitia ostrogothica* n. sp. *Beyrichia nana* Brogg., *B. nanella* Mbg. n. sp. *Ceratiocaris scanicus* n. sp. *Agnostus Sidenbladhi* var. *urceolatus* Sbg. mscr. n. var., *A. trinodus* Salt., *A. fossulatus* n. sp. *Shumardia oelandica* Mbg., *S. pusilla* Sars., *S. bottnica* Wiman, *S. Dicksoni* n. sp. *Parabolinella limitis* Brogg., *P. rugosa* Brogg. *Boeckia Mobergi* Wiman. *Acerocare norvegicum* Mbg. and Moller. *Triarthrus Angelini* Linrs. *Hysterolenus Tornquisti* Mbg., *H. ? laevicauda* n. sp. *Euloma ornatum* Ang. *Harpides rugosus* S. & B. *Ceratopyge forficula* Sars., *C. latelimbata* n. sp. *Dicellocephalus Broggeri* n. sp. *Apatocephalus serratus* S. & B., also var. *dubius* n. var. *Dicellocephalina dicraeura* Ang. *Symphysurus angustatus* S. & B., *S. incipiens* Brögg., *S. breviceps* Ang., *S. elongatus*

MOBERG (J. C.) and SEGERBERG (Carl O.)—Continued

n. sp. *Nileus armadillo* Dalm., *N. limbatus* Brögg. *Niobe insignis* Linrs., *N. insignis* var. *angustifrons* Sbg. n. var., *N. obsoleta* Linrs., *N. laeviceps* Dalm. *Megalaspis intacta* n. sp., *M. stenorhachis* Ang., *M. planilimbata* Ang. *Illaenus oriens* n. sp. *Orometopus elatifrons* Ang., *Holometopus Tornquisti* n. sp. *Ampyx domatus* Ang., *A. obtusus* n. sp. *Cyrtometopus primigenus Ang., C. foveolatus* Ang., *Cyrtometopus speciosus* Dalm. *Harpina (Harpes) excavata* Linrs. *Crossoura parvula* n. gen. et n. sp., *C. lata* n. sp.

Monke (H.) Beiträge zur Geologie von Schantung I—Obercambrianbrische Trilobiten von Yentsy-yai.

Jahrb. d. Preuss. Landesanstalt und Bergakad. zu Berlin, 23, pt. 1, 1903, pp. 103-151, plates.

An abstract of this paper was published by Woodward in Geol. Mag., Dec. v, vol. 2, 1905, pp. 211 and 251, with a plate.

The author remarks: *Drepanura Ketteleri* Monke (like *D. Premesnili* Berg.) is founded upon detached pygidia, and separate and imperfect head shields; it also has elongated cheek-spines, which remind one of the very long lateral cheek and caudal spines of *Bathynotus holopyga* Hall, from the Lower Cambrian of Vermont.

Woodward refers *Stephanocare Richthofeni* Monke to Meek's genus *Olenoides*.

The following species and genera are described by Monke: *Agnostus Koerferi* n. sp. *Liostracina Krausei* n. gen. et n. sp. *Teinistion Lansi* n. gen. et sp., *T. Sodeni* nov. *Drepanura Premesnilli* Berg., *D. Ketteleri* n. sp. *Stephanocare Gichthofeni* n. gen. et sp. *Stephanocare Sinense* Berg.

The following species, described by Walcott, Proc. Natl. Mus., vol. 29, 1905, are synonyms: *Ptychopariaceus* Walc. syn. of *Liostracina Krausei* Monke. *Dorypygella typicalis* Walc. syn. of *Teinistion Lansi Monke. Damesella chione* Walc., syn. of *Stephanocare Richthofeni* Monke. *Teinistion Lansi* Monke is similar to *Shantungia spinifera* Walc., but differs in the presence of an incurved frontal margin and the absence of the long frontal spine.

Moysey (Lewis). On some Arthropod remains from Nottinghamshire and Derbyshire Coal Field.

Geol. Mag., Decade V, vol. 8, 1911, pp. 497-507, text figures.

The author illustrates *Leaia trigoniodes* sp. nov.; also the glabellar region Prestwichia and the terminal segments of air-breathing Arthropod. It shows a thick and possibly calcareous integument. *Anthracosiro fritschii* Pocock, and other crustacea.

Narraway (J. E.) List of Trilobites found at Ottawa and immediate vicinity.

Ottawa Naturalist, vol. 26, No. 8, pp. 98-100, November, 1912.

Nason (Frank S.) The Geological relations and age of the St. Joseph and Potosi Limestone of St. Francis County, Missouri.

Am. Jour. Sci., 4th ser., vol. 12, 1901, pp. 358-361.

Nifantof (A.) Beitrage zum Studium der Fauna des Devons der Berge von Mugodjary.

Tomsk. Izv. Technol. Inst., vol. 21, 1911, p. 26, pl. 3, figs. 29-33.

Dithyrocaris sp.

Norton (Wm. H.) Variations in the position of the nodes on the axial segments of pygidium of a species of Encrinurus.

Proc. Iowa Acad. Sci., vol. 3, 1896, pp. 79-81.

The author remarks that in defining the different species of the genus Encrinurus, use has frequently been made of the disposition of the nodes on the joints of the axis of the pygidium. Foerste distinguishes *E. thresheri* from *E. ornatus* on this characteristic. The author gives the axial annulations of some 43 specimens from the Quarry at Mount Vernon, Iowa.

O'Connell (Marjorie). Summary of the distribution and occurrence of Eurypterids.

Geol. Soc. Am. Bull., vol. 24, pp. 498-515, 1913.

——— Description of some new Siluric Gastropods.

Bull. Buffalo Soc. Nat. Sci., vol. XI, 1914, pp. 93-101, plates 1-6.

Eurypterus Ruedemanni nov.

——— The habitat of the Eurypterida.

Bull. Buffalo Soc. of Nat. Hist., vol. XI, 1916.

The author gives a systematic review of the occurrence of the Eurypterida in each period from the Cambrian through the Permic.

Chapter 2. Résumé of the opinions on the habitat of the Eurypterida.

Chapter 3. The bionomy of the Eurypterid faunas.

Chapter 4. The Lithogenesis of the Eurypterid bearing beds.

Chapter 5. The geological and geographical distributions of the Eurypterids, with bibliography.

The conclusion reached by the author, after the study of all the available data, is that the Eurypterids throughout their entire phylogenetic history lived in the rivers. Schuchert in the earliest fresh water Arthropods, 1916, remarks that Eurypterids were marine animals previous to the Devonian, and that towards the close of the Silurian they became Eurhaline, or able to live in both salt and brackish water, and after Silurian time they probably became wholly restricted to the fresh water. Proc. Natl. Acad. Sci., vol. 2, 1916, p. 728.

Oehlert (D. P.) Sur les Trinucleus de l'ouest de la France.

Bull. Soc. Geol. France, 3rd ser., vol. 23, 1896, p. 299, plate.

Trinucleus Bureaui n. sp. The species is remarkable for the large tail. The author compares it with *T. ornatus*, the Bohemian form.

T. Grenieri Berg., *T. pongerardi* Roualt.

——— Fossiles Devonian Santa Lucia (Espagne). Primiere partie.

Bull. Soc. Geol. France, 3rd ser., vol. 23, 1896, p. 299, plates.

The author describes *Cryphaeus sublandiniatus* DeVern.

Cryphaeus (Malladaia) Luciae nov. sp. The author gives a figure in the text of this new subgenus, and compares it with Dalmanites and Phacops.

Cryphaeus Munieri Oehlert, and *Phacops Portieri* Bayle.

Cytherella cf. *subfusiformis* Sandberger.

——— *Uralichas Ribeiroi* des schistis d'Angers.

Mem. Soc. Geol. France, Palaeontologie, vol. 6, Fas., 1896.

——— Résumé des derniers travaux sur l'organisation et le developement des Trilobites.

Bull. Soc. Geol. France, ser. 3, vol. 24, 1896, p. 97.

Triarthrus Beckii Green.

Ohern (D. W.) and **Maynard** (T. P.) Trilobites.

Maryland Geol. Sur. Lower Devonian, Baltimore, 1913, pp. 489-512, pl. 89-94.

The authors describe and illustrate the following species:

Proetus pachydermatus Weller, *P.* cf. *protuberans* Hall. *Cordania cyclurus* Hall and Clarke. *Cyphaspis Australis* n. sp. Ohern. *Calymmene camerata* Conrad. *Homalonotus Swartzi* n. sp. Ohern, *H. Vanuxemi* Hall. *Phacops Logani* Hall. *Dalmanites aspinosa* Weller, *D. Keyserensis* n. sp. Swartz, *D. multiannulatus* n. sp. Ohern, *D. latus* n. sp. Ohern, *Dalmanites (Synphoria) stemmatus* Clarke, *D. (Coryccphalus) dentatus* Barrett, *D. micrurus* Green, *D. (Chasmops) anchiops* Green, *D. (Hausmannia) pleuroptyx* Green, *D. berkleyensis* n. sp. Swartz.

Olin (E.) Om de Chasmopskalken och Trinucleusskiffern motsvarande bildningarne i Skane.

Lund Geologiska Fältklubb, Ser. B, No. 1, 1906, 79 pp., with 4 plates.

Acidaspis Törnquisti n. sp. *Æglina rediviva* Barr. *Agnostus cingulatus* n. sp., *A. trinodus* Salt. *Ampyx globifrons* n. sp., *A. gratus* Barr., *A. Portlocki* Barr., *A. rostratus* Sars., *A. tenellus* Barr. *Areia succica* n. sp. *Asaphus ingens* Barr. *Calymmene dilatata* Tulb., *C. incerta* Barr., *C. pulchra* Beyr., *C. trinucleina* Linrs. *Chirurus insignis* Beyr., *C. pectinifer* Barr., *C. subulatus* Linrs. *Cybele* cf. *Grewingki* F. Schmidt. *Dindymene cornuta* n. sp., *D. pulchra* n. sp., *D.* sp., *D. spinulosa* n. sp., *D. venusta* n. sp. *Dionide euglypta* Ang. *Holometopus* cf. *aciculatus* Ang. *Illaenus Angelini* Holm., *I. longifrons* n. sp., *I. megalopthalmus* Linrs. *Lichas laxatus* McCoy, *L. quadrispinus* Ang. *Phacops ecclesiatica* n. sp., *P. cucentra* Ang., *P. macroura* Sjogr., *P. recurva* Linrs., *P. sandbyensis* n. sp. *Phillipsia parabola* Barr. *Proetus scanicus* n. sp. *Pseudosphaerexochus laticeps* Linrs., *P. Ravini* n. sp. *Ptychopyge glabrata* Ang. *Remopleurides latus* n. sp., *R. radians* Barr., *R. sexlineatus* Ang. *Sphaerexochus* sp. *Staurocephalus clavifrons* Ang. *Stygina latifrons* Port. *Symphysurus superstes* n. sp. *Trinucleus Bucklandi* Barr., *T. ceriodes* Ang., *T. elliptifrons* n. sp., *T. latilimbus* Linrs.

Pack (Fred J.) Cambrian fossils from the Pioche Mountains, Nevada.

Jour. Geol., vol. 14, pp. 290-302, plates 1-3, 1906.

Bathyuriscus howelli Walcott, *B. productus* H. & W. *Ptychoparia piochensis* Walcott, *P. Kempi* n. sp. This species is an allied form of *P. subcoronata,* but has a peculiar boss in front of the glabella.

Zacanthoides typicalis Walc., *Z. grabaui* n. sp., differs from *Z. typicalis* in general shape of the head, the frontal margin and the genal spines.

Packard (A. S.) The Palæontological History of Trilobites, etc., as opposed by Barrande to the evolution theory.

Amer. Naturalist, vol. 8, 1874, p. 439.

——— On the systematic position of the Trilobites.

Proc. Amer. Assoc., 1893, p. 365.

Refers the Trilobites to a separate class, and regards them as being an older, more primitive group than the Crustacea. Hence, the Trilobites probably were the first to originate from the annelid worms, while the crustacea arose by a separate line of descent.

Partridge (E. M. Miss). Echinocaris Whidbornes (Jones & Woodward) and *Echinocaris sloliensis* n. sp.

Geol. Mag., Dec. 4, vol. 9, 1912, pp. 307-308, plate 17.

The last species much resembles *E. sociales* (Beecher) by the carapace and is much longer in proportion to its width.

Parker (William A.) The fossil Arthropoda and Pices of Sparth, Rochdale.

Lancashire Naturalist Darwin, new ser., vol. 2, 1909, pp. 2-8.

Pygocephalus.

Parkinson (Harold). Ueber eine neue Culmfauna von Königsberg unweit Giessen and ihre Bedeutung fur die Gliederung des rheinischen Culm.

Inaugural Dissertation, Marburg, 1903, 46 pp., plates.

Trilobites: pp. 336-340, Zeitschr Deutsch Geol. Ges., 1902.

Griffithides seminifer Phillips. *Phillipsia Eichwaldi* Fischer nov. var. *hassiaca*, *P. gemmulifera* Phillips.

Perner (Jaroslav). Miscellanea Silurica Bohemiae.

Acad. Cisare Franktiska, Josefa, 1900.

The author describes *Cheirurus Hofmani* n. sp. pl. 1, figs 1-5.

Compares *Ch. pater* and *Ch. globosus*.

Perkins (G. H.) Geology of the Burlington Quadrangle.

7th Report Geology of Vermont, Bellows Falls, Vt., 1910, pp. 249-313, plates 53-62.

The author illustrates in the text *Triarthrus becki* Green, and in the plates without description the following species:

Harpes cassinensis Whitf. *Nileus stratus* Whitf. *Bathyurus perkinsi* Whitf. *Bolbocephalus seelyi* Whitf., *Bathyurus conicus* Whitf., *B. seelyi* Whitf. *Asaphus canalis* Conrad. *Isochilina cristata* Whitf., *I. gregaria* Whitf., *I. seelyi* Whitf.

Peach (B. N.) The Trilobites of the Silurian rocks of Southwest Scotland. Fauna, Flora and Geology of the Clyde area. Edited by C. F. Elliot, Malcolm, Laurie and J. Barclay Murdoch.

Brit. Assoc. Handbook, Glasgow, 1901, pp. 445-447.

List of Arthropoda of Scotland, pp. 450-455.

——— Scottish Palæontology during the last twenty years.

Proc. Phys. Soc. Edinb., vol. 14, 1902, pp. 361-394.

The author remarks under Schizopoda, that Pseudogathea agrees with Anthrapalaemon and must find a place with it. Both appear to me to be ancient forms of Lophogastrid schizopods. Huxley's Pygocephalus should be classed with the same group.

——— Monograph on the higher Crustacea of the Carboniferous rocks of Scotland.

Memoirs of the Geol. Sur. of Great Britain Palæontology, 1908, 822 pp. and 12 plates.

The author describes 34 species of fossil Schizopods.

The classification followed is chiefly based upon that adopted by G. O. Sars, arranged in two great groups, viz.:

1. The Mysid Group, including the families Lophogastridae, Perimecturidae, Anaspidae and Mysidae.

2. The Euphausiid Group has only one family, Euphausiidae.

Family Lophogastridae, Group No. 1.

Genus Tealliocaris gen. nov.

Body moderately long and slightly applanated; integuments firm and chitinous pitted or grained; carapace large, nearly one-half length of the body; seven trunk segments and externally more or less provided with longitudinal keels; rostrum spear-shaped,

PEACH (B. N.)—Continued

three-edged and denticulated; hinder part of carapace not produced into backwardly directed spines; caudal segments wide, single-lobed epimera; eyes large with papilla issuing from the pedicle; antennular peduncle long, slender, the flagella being short and of nearly equal length. First pair of legs much more massive than the succeeding ones, which are slender; branchiae given off from the base of all the seven pairs of legs with lobate sternal branches; telson large.

The author includes under this genus:

Tealliocaris loudonensis sp. nov., *T. woodwardi*, Etheridge, Jr.; described under the genus Anthrapalaemon in 1877; also a variety *Tealliocaris etheridgei* Peach (originally described under the genus Anthrapalaemon in 1882) with the var. *lata* Peach, *T. robusta* sp. nov. and var., *T. tarrasiana* sp. nov., *T. formosa* Peach (originally described as an Anthrapalaemon in 1882).

Genus Pseudo-Galathea Peach, 1883:

P. macconochiei Etheridge, Jr. (described in 1879 as an Anthrapalaemon), *P. rotuda* Peach, *P. ornatissima* Peach (described in 1882 as *Anthrapalaemon ornatissimus.)*

Genus Anthrapalaemon Salter, 1861:

The author restricts this generic name to such applanted forms as the type *A. grossarti* Salter. *Anthrapalaemon russellianus* Salter (originally described under Palaeocarabus in 1863), also var. *spinulosus* and var. nov.

Family Perimecturus gen. nov.:

The characteristic feature of this genus is the enormous development of the tail.

The author includes under this genus: *P. parki* and var. *duplicicarinatus*, *P. stocki* sp. nov., *P. elegans* sp. nov., *P. communis* sp. nov., *P. ensifer* sp. nov., *P. pattoni* Peach *(Palaesquilla pattoni* Peach 1888).

Family Anaspidae:

Genus Palaeocaris Meek & Worthen, 1868.

Palaeocaris scotica Peach, *P. landsboroughti* sp. nov.

Family Mysidae:

Genus Palaemysis gen. nov.

Trunk unknown; tails long and fusiform, and segments supplied with well-developed epimera and well-developed pleopods. External branches of the uropods much longer than the forked telson; internal branches of uropods short so that the tail fan is deeply forked.

The author included in the genus:

Palaemysis dunlopi sp. nov., *P. couttsi* sp. nov. and *P. tenuis* sp. nov.

Family Euphausidae:

Genus Anthracophausia gen. nov.

Elongated laterally compressed, prawn-like forms, with thin, smooth chitinous integuments; carapace one-third the length of the body; peduncle on antenules long and massive, with last 2 joints extending beyond the rostrum; antenna, with basal scale and with flagellum longer than those of antennule; 7 pairs of legs, uniform; tail segments with deep epimera, all directed downwards and backwards; first 2 pairs of appendages of tail in the males very massive and specially modified for sexual purposes; telson as long as the uropods, and furnished near its ends with 2 articulated plates, one on each side.

The author describes *Anthracophausia dunsiana* sp. nov. with var. *obesa* and *A. traquairi* Peach.

Genus Crangopsis Salter, 1863; syn. the Palæocrangon and Uronectes Salter, 1861. *Crangopsis socialis* Salter, *C. rhodesi* sp. nov., *C. magna* sp. nov., *C. couttsi* sp. nov., *C. robusta* sp. nov., *C. eskdalensis* Peach (originally described under the genus Palæocrangon in 1882), *C. elegans* Peach (described in 1883 under the genus Palæocrangon), and *C. hastata* sp. nov., also *C. minuta* nov.

Persson (Emil). Till kännedonen om Oleniderna i Zone n med Eurycare Och Leptoplastus vid Andrarum 1.

Meddel No. 11, fr. L. G. F. Geol. Fören. i Sthlm. Förhandl., Bd. 26, 1904.

Pocock (T.) The geology of the country around Macclesfield, Congle, Crewe and Middlewich.

Mem. Geol. Sur. Eng. London, 1906, p. 110.

Pompeckj (J. F.) Die Fauna des Cambrium von Tejrovic and Skrej in Bohmen.

Jahrb. d. k. k. Geol. Reich, 1895, Bd. 45, Heft 2 and 3, pp. 495-614, plates 13-17.

Agnostus section Laevigati: *Agnostus nudus* Beyr., *A. bibullatus* Barr.

Agnostus section Limbati: *Agnostus rex* Barr., *A. granulatus* Barr. *Agnostus integer* Barr., also var. *spinosa* n. var. *Paradoxides spinosus* Boeck, *P. rotundatus* Barr., *P. rugulosus* Corda, *P. imperialis* Barr., *P. orphanus* Barr., *P. expectans* Barr., *P. inflatus* Barr., *P. pusillus* Barr., *P. Jahni* n. sp. *Hydrocephalus carens* Barr., *H. saturboides* Barr. *Conocoryphe Sulzeri* Schloth., *C. (Ctenocephalus) coronata* Barr. *Ptychoparia striata* Emm., also var. *tenuis* n. var., *P. (Conocephalites) Emmrichi* Barr., *P. (Conocephalites) marginata* n. sp. *Solenopleura torifrons* n. sp., *S.? conifrons* n. sp. *Agraulos ceticephalus* Barr., *A. spinosus* Jahn. *Ellipsocephalus Hoffi* Schloth., *E. Germari* Barr., *E. vetustus* n. sp. *Protypus? bohemicus* n. sp. *Sao hirsuta* Barr.

——— Ein neuentdecktes Vorkomen von Tremadoc-Fossilien bie Hof. Munchen, 1896.

Bavarilla Hofensis Barr. *Dikelocephalus? bavaricus* Barr. *Niobe inotata* Barr., *N. discrepans* Barr.

——— Ueber Calymmene Brongniart.

Neuen Jahb. Mineral. Geol. Pal. Jahrg., 1898, vol. 1.

The Calymmenidae are divided as follows:

1. Subgenus Pharostoma Corda type, *P. pulchrum* Barr.
2. Subgenus Calymmene type, *C. tuberculata* Brunn.

First Family—*Calymmene senaria* Conrad.

Second Family—*Calymmene cambrensis* Salter.

1. Synhomalonotus type, *Calymmene Tristani* Brong.
2. Synhomalonotus type, *Calymmene Arago* Roul.
3. Subgenus Ptychometopus type, *P. Volborthi* Schmidt.

——— Versteinungen der Paradoxides Stufe von La Cabitza in Sardiniens und Bermerkungen zur Gliederung des Sardischen Cambrium.

Zeitschr. Deutsch Geol. Ges., 1901, pp. 1-23, plate.

Paradoxides mediterraneus n. sp. *Conocoryphe Héberti* Mun-Chalm et Berg. *Ptychoparia* sp. *Olenopsis Bornemanni* Menegh. *Olenellus (Holmia) Broggeri* Walc. *Conocoryphe Levyi* Mun-Chalm et Berg.

The new name of *Paradoxides mediterraneus* is given to *P. rugulosus* Bergeron Massif. Ancien, p. 336, pl. 2, f. 5-7.

Price (W. Armstrong). Notes on the Palæontology of Boone County.

Geol. Sur. West Virginia, p. 614.

Griffithides scitulus Meek and Worthen.

Prosser (Charles) and **Kindle** (Edward M.) Geol. Sur. Maryland Middle Devonian.

Baltimore, 1913, pp. 326-335, pls. 42-44.

The authors describe the following Fossil Crustacae:

Trilobita: *Cryphaspis Stephanophara* Hall. *Homalonotus DeKayi* Green. *Phacops rana* Gr., *P. cristata* Hall and var. *pipa* Hall.

Dalmanites (Cryphaeus) Boothi Gr.

The genus Cryphaspis was proposed by Dr. Green for certain Devonian Trilobites, in 1837, Am. Jour. Sci., vol. 32, 1837, p. 343, with figures of the genotype *Cryphaeus Boothi* and *C. calliteles.*

The term was pre-occupied for the Coleoptera in 1833.

Burmeister Org. Tril, 1843, under his sub-group Phacops, in which the pygidium has long spines on its circumference, classes *Asaphus archnoides* Goldf., a similar species, under Phacops. This species is now referred to *Cryphaeus punctatus* Steininger, 1831.

Milne Edwards Hist. Nat. Crust., vol. 3, 1840, pl. 34, fig. 8, copies Hoeninghaus's figure of *Calymmene archnoides,* 1833, and refers it to his new genus Pleuracanthus, at this time pre-occupied by Agassiz and Gray for fossil fish, 1832.

Corda Mong., Böhm Tril, 1847, p. 242, pl. 6, fig. 67, uses the term Metacanthus for *Phacops stellifer* Burmiester, and that of Asteropyge, on p. 241, with *Calymmene arachnoides* Goldf. as the genotype.

All the species described under Cryphaeus Green should take the generic name of Asteropyge Corda.

In the European species of this genus the terminal spine upon the pygidium generally exceeds in length all of the five marginal spines on each side.

Provost (Pierre). Notes sur les Entomostraces bivalves du terrain Houiller du Nord de la France.

Lill. Ann. Soc. Geol., vol. 40, 1911, pp. 60-80, plate.

Phyllopoda Estheria simoni n. sp. *Estheriella reumauxi* sp. nov.

Raymond (Percy E.) The Crown Point section.

Bull. Amer. Palæontology, vol. 3, No. 14, 1902, plates 18 and 19.

Gives list of Chazy fossils, including Trilobites and figures of *Thaleops ovatus* Conrad. *Bathyurus spiniger* Hall.

——— Notes on the names Amphion, Harpina and Platymetopus.

Amer. Jour. Sci., vol. 29, 1903, pp. 377-378.

Changes preoccupied name Amphion to Pliomera Ang. Harpina to Eoharpes n. gen. Platymetopus to Amphilichas n. gen.

——— The Trilobites of the Chazy Limestone.

Ann. Carnegie Mus., vol. 3, 1905, pp. 328-386, plates.

Harpina antiquatus Bill., *H. Ottawaensis* Bill. *Lonchodomas Halli* Bill. *Remopleurides canadensis* Bill. *Bathyurus Angelini* Bill. *Bathyurellus brevispinus* n. sp., *B. minor* n. sp. *Asaphus marginalis* Hall. *Asaphus* sp. *alpha beta* and *gamma. Isotellus Harrisi* n. sp., *I. obtusum* Hall, *I. angusticaudum* n. sp., *I.? Beari* n. sp. *Illaenus indeterminatus* Walc., *I. punctatus* n. sp., *I. Bayfieldi* Bill., *I. globosus* Bill., *I. Erastusi* n. sp. *Thaleops ovata* Conrad. *Proetus Clelandi* n. sp. *Lichas (Platymetopus)* Ang. this subgenus changed to *Amplilichas* n. subgen. by the author in another publication *(Platymetopus minganensis* Bill.). *Acidaspis* (subgen. *Glaphurus* n. subgen.). *Glaphurus pustulatus* Walc., *G. primus* n. sp. *Cybele valcourensis* n. sp.

RAYMOND (Percy E)—Continued

Amphion canadensis Bill. *Ceraurus pompilius* Bill., *C. hudsoni* n. sp. *Pseudosphaerexochus vulcanus* Bill., *P. vulcanus* var. *Billingsi* n. var., *P. approximus* n. sp., *P. Chazyensis* n. sp., *P. (Nieszkowskia) satyrus* Bill. *Sphaerocorphe Goodnovi* n. sp. *Sphaerexochus parvus* Bill. *Dalmanites (Pterygometopus) annulatus* n. sp.

Seven genera—Thaleops, Proetus, Glaphurus, Cybele, Sphaerocorphe, Sphaerexochus and Pterygometopus—make their first appearance in American faunas in the Chazy formation.

Three, Bathyurellus, Glaphurus and Amphion, are not found in formations above the Chazy.

Most of the genera found in the Trenton are represented in the Chazy.

——— The fauna of the Chazy Limestone.

Amer. Jour. Sci., vol. 20, 1905, pp. 353-382.

Leperditia limatula n. sp.

The new generic name of Heliomera is used for *Cheirurus sol* Billings, as the type.

——— Trilobites of the Chazy Formation in Vermont.

7th Report of the State Geologist, 1909-1910, Bellows Falls, Vt., 1910, pp. 213-248, plates 32-40.

This paper was published in Ann. Carnegie Mus., vol. 3, No. 2, 1905; but this article has all been reconstructed and important additions have been made.

The subgenus *Vogdesia*, on p. 225, has been given a generic name with *Isotelus bearsi* as the type.

Nileus vigilans Meek and Worthen, as figured in Palæont. Minnesota, vol. 3, part 2, p. 712, figs. 17-19, the author compares with *Nileus Perkinsi*, which differs principally in respect to the eyes, which are much larger and further back on the cephalon in *N. Perkinsi*.

The species illustrated and described are:

Eoharpes antiquatus Bill., *E. ottawaensis* Bill. *Lonchodomas halli* Bill. *Remopleurides canadensis* Bill. *Bathyurus angelini* Bill. *Bathyurellus brevispinus* Raym., *B. minor* Raym. *Basilicus marginalis* Hall. *Vogdesia bearsi* Raym. *Onchometopus obtusus* Hall. *Isotelus harrisi* Raym., *I. platymarginatus* Raym. *Isotelus beta* Raym. *Bumastus limbatus* Raym. *Isoteloides augusticaudus* Raym. *Thaleops arctura* Hall. *Bumastus globosus* Bill., *B. erastusi* Raym. *Illaenus punctatus* Raym. *Proetus clelandi* Raym. *Amphilichas minganensis* Bill. *Glaphurus pustulatus* Walc. *Cybele prima* Raym. *Pliomerops canadensis* Bill. *Ceraurus pompilius* Bill., *C. hudsoni* Raym. *Pseudosphaerexochus vulcanus* Bill., *P. vulcanus billingsi* Raym., *P. approximus* Raym., *P. chazyensis* Raym. *Nieszkowskia satyrus* Bill. *Sphaerexochus parvus* Bill., *S. goodnovi* Raym. *Pterygometopus annulatus* Raym. *Isotelus harrisi* Raym., *I. platymarginatus* Raym. *Basilicus marginalis* Hall. *Ceratocephala narrawayi* Raym. *Heliomera sol.* Bill. *Nieszkowskia* or *Pseudosphaerexochus*.

——— On two new Trilobites from the Chazy near Ottawa.

The Ottawa Naturalist, vol. 24, Nov., 1910.

The author describes *Bathyurus superbus* n. sp., closely related to *Bathyurus extans* Hall, but larger.

Isotelus arenicola n. sp.

This species is more closely allied to *Isotelus gigas*, but this species has no genal spines like the new species.

——— Notes on Ordovician Trilobites, II. Asaphidae from the Beekmantown.

Ann. Carnegie Museum, vol. 7, No. 1, 1910, pp. 36-44, plate 14.

The author places a new genus under the family *Asaphidae (Isoteloides)*. In this

RAYMOND (Percy E)—Continued

genus the glabella does not reach to the front of the cephalon, nor does it expand towards the front; it has also almost obsolete neck and dorsal furrows with a long and narrow form.

The author takes *Isoteloides Whitfieldi* for the type. This species is the *Asaphalus canalis* Whitfield, Bull. Am. Mus., vol. 1, p. 336, pl. 34, f. 1-8, not that of Conrad or Hall.

Hall credits the name to Conrad in MSS. and figures the hypostoma and doublure from Chazy Village, New York. This is probably what is now known as *Isotelus Harrisi* Raymond.

On account of the facial suture termination at a point in the middle of the anterior margin, the author classes as Isoteliform suture the genera Asaphellus, Asaphus and Isotelus.

In Niobe the suture cuts the anterior margin in front of the eyes, and follows around the frontal margin, as in Nileus; classed as the Niobiform suture.

The genera with forked hypostoma and with Isoteliform suture are arranged:

Asaphidae—Asaphus, Onchometopus Ptychopyge, Isoteloides and Isotelus. Basilicus is the only member with Niobiform suture. This form is common with the undivided hypostoma as in Ogygia, Ptychocheilus, Asaphelina, Niobe, Symphysurus, Illaenurus, Nileus Barrande, Homalopteon and Platypeltis.

A few genera with undivided hypostoma have Isoteliform suture, namely: Megalaspis, Megalaspides and Asaphellus.

The author describes *Asaphellus gyracanthus* n. sp. (*Asaphus canalis* Cleland), *A. monticola.* Subgenus to Niobe, Hemigyraspis n. gen. This genus is proposed with *Asaphus affinis* McCoy as a type. *H. collieana* n. sp.

The author includes *Ogygia desiderata* Barr. *Niobe menapiensis* Hicks, and *N. solvensis* Hicks. *Asaphellus planus* Matt. in the genus.

Megalaspis and *Megalaspides.*

Sub-family Asaphidae:

Asaphidae, hypostoma forked.

Section 1: Asaphidae with anterior limb of facial suture marginal Basilicus.

Section 2: Asaphidae with anterior limb of suture intra-marginal, Pythopyge, Pseudasaphus, Asaphus, Onchometopus, Isotelus, Isoteloides.

The author describes and figures *Asaphus marginalis* Hall, under the genus Basilicus, including as the young of this species *Asaphus alpha* and *A. gamma* Raymond.

The author remarks that the species is closely allied to *Basilicus tyrannus* Murch.

The pygidium figured shows two lobes somewhat similar to that of *Dicellocephalina dicraeura* Ang., as illustrated by Moberg, pp. 1-5, f. 14, Kongl. Fysiogr Söllsk. Handl., Ang., Bd. 17, No. 7, 1906.

Onchometopus obtusus Hall. *Isotelus harrisi* Raym., *I. platymarginatus* n. sp., *I. beta* Raym. *Isoteloides angusticaudus* Raym. *Nileus perkinsi* n. sp.

Subgenus Vogdesia.

The thorax is similar to that of Nileus, as is the pygidium. The cephalon, which is short and broad, is also similar to that of *Nileus,* but differs from it in having smaller and much more elevated eyes, and deeper dorsal furrows.

The author refers *Nileus vigilans* (M. & W.) as figured by Clarke, Palaeont. Minnesota, vol. 3, p. 713, and *Isotelus bearsi* Raym. to this genus. *Thaleops arctura* Hall, refers *Illaenus ovatus* Raym. to this species. *Bumastus globosus* Billings, *B. erastusi* Raym., *B. limbatus* n. sp. *Amphilichas minganensis* Billings. *Ceratophala narrowayi* n. sp. *Glaphurus pustulatus* Walc., *Cybele prima* Raym.

The author figures *Pliomera fischeri* Eich. *Pliomerops canadensis* Bill., *P. pseudoraticulatus* Portk., *P. barrandei* Bill., *P. senilis* Barr. The new genus Pliomerops, with

RAYMOND (Percy E)—Continued

P. canadensis as its type, the author suggested, Am. Jour. Sci., vol. 19, 1905, p. 377, for the species of *Amphion (Pliomera)*, in which the cephalon has a denticulate frontal border, while the other species have smooth borders.

Subgenus Nieszkowskia sp. ind.

Subgenus *Heliomera sol* Billings.

Sphaerocoryphe goodnovi Raym.

Symphysurus Convexus Cleland, syn. *Illaenurus columbiana* Weller and *Bathysurus ? levis* Cleland.

The author gives illustrations of *S. sicardi* Berg. and *Illaenurus quadratus* Hall.

——— Notes on Ordovician Trilobites, III. Asaphidae from the Lowville and Black river.

Ann. Carnegie Mus., vol. 7, No. 1, 1910, pp. 46-59, plates 15-16.

In this paper the species *Bathyurus longispinus*, the hypostoma of *B. extans*, the free cheek of *B. spiniger*, and cephalon of *Isoteloides homalonotoides* are figured for the first time.

The author illustrates *Basilicus romingeri* Walc., placing as syn. *Asaphus Wisconsensis* Walc. and *Ptychopyge ulrichi* Clarke.

Under the genus Onchometopus, which may be readily distinguished from *Isotelus* by the presence of a median tubercle on the glabella; the absence of a concave border on both cephalon and pygidium, the author illustrates *O. simplex* n. sp.

Under the genus *Isoteloides* the author places *Asaphus homalonotoides* Walc.

The paper also includes notes on *Isotelus gigas* Dekay, *I. maximus* Locke.

——— Notes on Ordovician Trilobites, IV. New and old species from the Chazy.

Ann. Carnegie Mus., vol. 7, pp. 60-79, plates 17-19, 1910

The material on which this paper is based is two collections, the first by the author, and the second by Dr. Perkins, State Geologist of Vermont, from Isle La Motte, which was published in advance of the State Report.

The author notes *Eoharpes antiquatus* Billings. *Remopleurides canadensis* Billings.

The author divides the family Asaphidae Emmerich into two sections. Ogyginae nov. Asaphidae with hypostoma entire and 8 segments in the thorax. Geologically the more ancient.

Section 1—Ogygina with anterior limb of facial suture marginal. Ogygia, Niobe, Asaphellus, Symphysurus, Nileus, Vogdesia, Illaenurus.

Section 2—Ogyginae with anterior limb of suture intra-marginal.

——— Notes on parallelism among the Asaphidae.

Trans. Royal Soc. of Canada, 3rd ser., vol. 5, sec. iv, 1912, pp. 111-120, plates 1-3.

The author remarks: On the ontogeny of the Asaphidae very little is known; also that from the observation of various authors, the following may be looked upon as primitive characters in this family:

1. Strongly segmented cephalon and pygidium.
2. Absence of depressed borders.
3. Long glabella.
4. Eyes distant from the glabella.
5. Facial suture marginal in front of the glabella.
6. Pygidium and cephalon short and broad.
7. Axial lobe narrow.
8. Genal spines present.

Judged merely by these characteristics Ogygopsis, Ogygiocaris, Ogygites, Asaphus,

RAYMOND (Percy E)—Continued

Niobe, Symphysurus and Basilicus, are more primitive than Isotelus, Nileus, Ptychopyge, Hemigyraspis and Asaphellus.

The author quotes Brögger's studies on the hypostoma and his division of three distinct types.

Pointed behind, Megalaspis and Ogygiocaris.

Quadrate, *Niobe insignis.*

Extended behind into two long, large prongs, Asaphus, Isotelus, etc. He remarks under the Geologic range, that the Asaphids appear earlier in America and have a longer range than in any other country.

The Cambrian, which have entire hypostomas, consists of the genera Ogygopsis, Illaenurus, Symphysurus, Asaphellus, Hemigyraspis and Megalaspis.

Ordovican, Beekmantown, the Asaphids are less varied as only Isoteloides and Nileus are present.

In the Chazy, Isotelus, Isoteloides, Basilicus, Onchometopsus, Vogdesia and Nileus occur.

In the Silurian, in the Lowville (Silurian) and Back River (Ordovian), the genera Onchometopus, Isotelus, Isoteloides, Basilicus and Vogdesia.

In the Trenton there are, so far as is now known, only Isotelus and Isoteloides.

In the Utica, Isotelus and Ogygites.

In the Richmond, Isotelus, Onchometopus, Brachyaspis and probably Ogygites.

The author uses *Asaphus expansus* as the type of the genus, which is characterized by its short, broad head, and pygidium from which all depressed borders are absent; by the rather prominent glabella, which expands towards the front and reaches the anterior margin; the large eyes; the course of the anterior portion of the frontal suture, which meets in a point in front of the eye; and the short pygidium, with narrow, well-defined axial lobe and smooth pleural lobes.

The genus is well developed in the Baltic Region.

Under the heading of lines of development from the Asaphus, the author remarks that the variation in the Ordovician Baltic species seems to be in the direction of the obliteration of furrows on the surface; that is a further loss of evidence of original segmentation in cephalon and pygidium.

Onchometopus differs from Asaphus, in having the glabella less marked, the axial lobe of the thorax wider, the thoracic segments flatter, the axial lobe of the pygidium less convex and without rings.

Megalaspides, like Asaphus, with narrow axial lobe, expanding glabella, no depressed border on the pygidium, but with a narrow one on the front of the cephalon.

Isoteloides, in which both the cephalon and pygidium have depressed borders.

Isotelus, in which the axial lobe of the thorax is wide, the glabella and the axial lobe of the pygidium so ill-defined as to merge into the general surface of the head; therefore, both these smooth trilobites and species of Brachyaspis and Onchometopus are so like Isotelus, that the three genera can only be separated by their lines of development.

Basilicus is a primitive genus, with forked hypostoma, with a strongly ribbed tail; the facial suture marginal in front, and the glabella strongly outlined and shows glabella furrows.

The author remarks from Basilicus, Ogygites seems to have developed.

Tromelin and Lebesconte, Assoc. Francaise, Adv. Sci., 1875, p. 33, use the new generic name of Ogygites for Brongniart's Ogygia, it having been used for other genera in natural history. These authors use O. Desmaresti Brog. for the type, and include O. Brongniarti Rou. as a syn. The same authors refer Ogygia, the first species described under the genus by Brongniart, to the genus Asaphus.

RAYMOND (Percy E)—Continued

The author considers Pseudoasphus Schmidt as the next step in the development from Basilicus and Ogygites.

The author is in error in his remarks that Brongniart applied the name of Ogygia to *O. buchii* and *O. dilatata* with forked hypostoma. Brongniart applied the name to an Asaphus. The second species described by Brongniart, according to Tromelin and Lebesconte, *ibid*, p. 34, has the entire hypostoma characteristic of *O. desiderata* Barr. Syst. Sil de Bohéme, vol. 1, Suppl., pl. 4, fig. 3.

The author illustrates *Brachyaspis notans* Billings. *Ogygites canadensis* Chapman. Remarks: this species has a forked hypostoma, and should not be included under the genus.

Plate 2—*Onchometopus susae* Whitfield. *Brachyaspis alacer* Bill., *B. altilis* Raym. n. sp. *Megalaspis goniurus* Bill. *Isotelus gigas* DeKay. *Nileus perkinsi* Raym.

Plate 3—*Nileus perkinsi* Raym. *Onchometopus obtusus* Hall. *Bumastus globosus* Bill. *Nileus affinis* Bill. *Symphysurus illaconoides* Bill. *Isotelus gigas* DeKay, and *Hemigyraspis* sp.

——— Some changes in the names of genera of Trilobites.

The Ottawa Naturalist, vol. 26, Feb., 1913.

The author remarks on the ten new genera described by Jaekel in Zeit. d. Deutsch Geol. Ges., vol. 61, pp. 380-401, 1909, should be rejected and referred to older names as follows:

Paragnostus to Condylopyge Corda, Dichagnostus to Pleuroctenium Corda, Mesagnostus to Peronopsis Corda, Miagnostus to Lejopyge Corda, Leiagnostus to Phalacroma Corda, Metagnostus to Arthrorhachis Corda. These six new genera the author rejects.

The author would reject Microdiscus Emmons, because it was founded on a young specimen of the genus Trinucleus, and substitutes Eodiscus. This would overlook Salter's Microdiscus—the generic name should read Microdiscus Salter (not Emmons).

Raymond, who examined the type specimen of *Pemphigaspis bullata* Hall, does not place it with Microdiscus, as suggested by Walcott.

The author is in favor of using Green's generic name Cryptolithus for Murchison's genus Trinucleus. This generic name has long been used by Bronn, Goldfuss, Emmrich, Angelin, Foerste and Vogdes. Eaton's genus Nuttainia of 1832 not used. Dr. Jacob Green claimed priority in his Monograph of Trilobites. The generic name was first described in Am. Jour. Geol., June, 1832.

The author uses Ogygites, Tromelin and Lebesconte, for primitive Asaphinae, with annulated pygidia and forked hypostomata, and Ogygiocaris Angelin, for *Ogygia Buchi* and *O. dilatata*.

The author favors the adoption of Goldius for Brontes and Bronteus. For Acaste Goldfuss, the author takes the generic name Phacopidella. Reed, 1906, as Leach in 1811, used the first genus for a genus of Cirripedes. Arges was used by Haan in 1835, and the author uses Ceratarges Gurich, for the generic name; also Aulacopleura Corda, in place of preoccupied generic name Arethusina Barrande.

——— Notes on Cyclosytoides.

Notes on some new and old Trilobites in the Victoria Memorial Museum. Description of some new Asaphidae. Two new species of Tetradium. Revision of the species which have been referred to the genus Bathyurus (preliminary paper).

Bull. No. 1, Victoria Memorial Museum, October 23, 1913, 80 pp., with 7 plates.

The author remarks on *Harpes dentoni*, which he refers to the new genus Eoharpes from a more, or rather poorly preserved specimen, that it has from 18 to 16 segments

RAYMOND (Percy E)—Continued

in the thorax, as it is not possible to tell where the pygidium begins. He compares the species with *E. ottawaensis.* In front of the glabella the brim of *E. dentoni* is narrow, deeply concave, and the anterior rim is curved upward; while in *E. ottawaensis* the brim, at the front, is wide and nearly flat.

The author also describes and illustrates *Bumastus billingis* R. & N. *Holasaphus moorei* Matthew. *Pseudosphaerexochus apollo Billings,* to which he refers the *Amphion cayleyi* Billings and *Ceratocephala goniata* Warder.

VI. Description of some new Asaphidae.

The author includes under the genus Hemigyraspis, a specimen figured in Trans. Roy. Soc. Canada, vol. V, pl. 3, fig. 7, for a form similar to *Asaphellus planus* Matthew, which the author now refers to *Hemigyraspis meconnelli* sp. nov. Including under the genus this species, also *Asaphellus planus* Matthew and *Hemigyraspis collicana* Raymond, 1910.

The author used as a type for his subgenus Hemigyraspis, *Asaphus affinis* McCoy, as described by Salter, Mong. Brit. Tril., pl. 24, figs. 13-14, p. 164, and included *Ogygia desiderata* Barr. *Niobe menapiensis* Hicks and *N. solvensis Hicks* with the above species.

Under *Basilicus Barrandi* Hall, the author remarks that this species has evaded the eyes of the describers of Trilobites, and it was not until recently that the writer's curiosity to know what form it was which Vogdes referred to Ogygia (Catalogue of Trilobites, p. 324) caused him to unearth it.

Raymond places as syn. to Hall's species *Asaphus wisconsensis* and *romingeri* Walcott, 1879. *Ptychopyge ulrichi* Clarke, and *Basilicus romingeri* R. & N.

Under the Genus Ogygites Tromelin and Lebesconte, 1875.

The author describes and illustrates *Ogygites canadensis* Chapman, referring as syn. *Asaphus halli* and *hinksii,* and comparing *Asaphus latimarginatus* Hall, with the species.

The author describes as new *Isotelus latus,* differing from *I. gigas* in having all its parts much wider.

Raymond remarks, that the Museum contains a number of specimens of Isotelus from St. Joseph Island, from which Stokes in 1823 figured a specimen as *Asaphus platycephalus,* which compares well with DeKay's *I. gigas* of 1824, and advocates the dropping of DeKay's species.

The following authors use *platycephalus* Stokes, in preference to DeKay's name of *I. gigas:* Bronn in 1835, Buckland in 1840, Burmeister in 1843, Roemer in 1851-56, Nieszkowski in 1857, Billings in 1863, and Vogdes in 1893. I think due credit should be given to Stokes and eliminate *gigas.*

The author also describes and illustrates *Isotelus maximus* Locke, and *Brachyaspis altilis* Raymond, the *Asaphus platycephalus* Billings. (Catalogue of Silurian Fossils of Anticosti, p. 26, fig. 9b.)

VII. A revision of the species which have been referred to the genus Bathyurus.

The author states that Billings erected the genus Bathyurus with *Asaphus extans* Hall, for the type, and described many species under it. Some 50 species have been referred to this genus; but in the revision the author only includes twelve, including three new species.

Under the Family Bathyuridae Walcott, the author gives a revised generic description and describes the following species:

Bathyurus extans Hall, *B. perplexus* Billing, probably a synonym of *B. extans, Bathyurus johnstoni* sp. nov. closely allied to *B. extans.* Bathyurus sp. intermediate between *B. extans* and *B. superbus. Bathyurus superbus* Raymond. This species attains a larger size than any other known Bathyurus. *B. longispinus* Walcott, *B. amplimar-*

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ginatus Billings (syn. *B. minganensis* Bill.), *B. glandiccphalus* Whitf., *B. angelini* Billings, *B. acutus* sp. nov., *B. arcuatus* Bill., *B. spiniger* Hall, *B. ingalli* sp. nov. and *B. schucherti* Clarke.

With *Bathyurus mero* Bill., for a type the author proposes the new genus Petigurus.

The genus is closely allied to Bathyurus, but differs as follows:

The facial suture reaches the posterior margin near the genal angle, the anterior end of the glabella overhangs the concave border; glabellar furrows are entirely absent, and the eyes are somewhat farther forward. The pygidium is without concave border, the ribs of the pleural lobes are reduced to nodes, and the axial lobe is ringed for almost its entire length.

Petigurus Nero (Billings) an Irish species described by Reed, 1910, as *Bathyurus* aff. *nero,* differs in the posterior end of the facial suture, turns sharply outward behind the eye, forming a broad, fixed cheek, different from *Petigurus nero,* and from any species of Bathyurus.

The author also refers to the genus *Petigurus cybele* (Billings).

Family Solenopleuridae Angelin:

The author gives the following diagnosis of his new genus Hystricurus: Type *Bathyrus conicus* Billings.

Glabella conical, tapering towards the front, outlined by deep furrows at sides and front; glabella furrows absent; fixed cheeks long, extending nearly to the genal angle; dorsal furrows paralleled by a narrow, convex ridge; eyes of medium size, situated opposite the middle of the glabella; cranidium with deeply concave border in front; pygidium rounded, with concave border, axial lobe prominent, with 5 rings, and there are 5 pair of ribs on the pleural lobe; surface smooth or pustulose.

In addition to the type which the author illustrates, he includes under the genus *Hystricurus crotalifrons* (Dwight, 1884) and *H. cordai* (Billings), *B. seelyi* Whitf. Bull. Am. Mus., vol. 2, p. 62, pl. 13, figs. 8-14, as a synonym, and not *B. seelyi,* vol. 1, 1886, referred to *Bolbocephalus.*

Family Proetidae Barrande:

Genus Haploconus nov. This genus is proposed to include Trilobites related to Cyphaspis, but differing in not having isolated basal lobes on the glabella, and in having a less prominent axial lobe on the pygidium. Type *Bathyrurus smithi* Billings.

The author describes *H. smithi,* and includes in the genus *Cyphaspis ? galeuensis* Clarke, and probably *C. ? brevimarginata* Walcott.

Family Dikelocephalidae, Miller, 1889:

Miller includes in the family Dicellocephalus, Pterocephala and Ptychaspis.

The author proposes the new genus Platycolpus, for *Bathyurus capax* Billings, a Trilobite with hemispheric, rather smooth cephalon, a depressed glabella extending to the anterior border, which is a flat, striated rim; glabella furrows faint or absent; eyes small, situated midway on the length of the head; facial sutures cutting the posterior margin just inside the genal angles, and the anterior margin in front of the eye.

Pygidium semi-circular, without depressed border and with faint traces of segmentation.

The author describes *Platycolpus capax* (Billings), *P. catoni* Whitf., which has faint glabella furrows, also *P. dubius* with a more pointed glabella, and *P. barabuensis* Whitf. with a more convex glabella.

Family Agraulidae Dalman:

Under the new genus Plethopeltis with *Agraulos saratogensis* Walcott, for the type the author gives the following diagnosis:

Cephalon strongly convex, wider than long, without concave border or marginal rim; glabella faintly defined, without glabella furrows; eyes small, situated well for-

RAYMOND (Percy E)—Continued

ward; free cheeks, rather wide, smooth, with short spines at the genal angles; pygidium small, with few traces of segmentation; convex; no border.

The author also includes *Plethopeltis armatus* (Billings) described under Bathyurus by Billings in 1860.

Family uncertain.

Goniurus nov. Type *Bathyurus perspicator* Billings, 1865.

Type diagnosis for this genus includes Trilobites, in which the facial suture, as in Bathyurus, except that the fixed cheek extends a little farther towards the genal angle; eyes very long, narrow and close to the glabella; glabella long, reaching almost to the frontal margin, tapering rapidly in front of the eyes; neck furrow sharp, extending across fixed and free cheeks; genal angles with short, sharp spines; a narrow, elevated rim extends around the whole cephalon, and the cephalon is slightly nasute in front; pygidium convex, triangular, with a long terminal spine.

Goniurus perspicator (Billings), *G. caudatus* (Billings), *G. elongatus* n. sp.

Matthew, Trans. Roy. Soc. Canada, vol., 1895, p. 269, referred to *Bathyurus candatus* Billings, as a possible species of this genus Holasaphus; but the pygidium has no furrow within the border.

Genus Lloydia Vogdes, 1890.

This genus was proposed by Vogdes in Bull. U. S. Geol. Sur., No. 63, p. 97, for *Bathyurus bituberculatus* Billings, in honor of the first author on Trilobites.

Edward Lloyd published in Philosophical Trans., vol. 20, No. 243, p. 279, 1698, the first description of Trilobites.

Dr. Billings, in the Canadian Naturalist and Geologist, vol. 5, 1860, p. 317, provisionally refers to his genus Bathyurus, two species of fossils from Point Levi as *Bathyurus dubius* and *B. bituberculatus* figs. 21 and 22. The second species, which is represented by a rough woodcut, presents a glabella, somewhat tumid and extending to the front margin, with basal lobes elongated, oval and pointed at both ends, separated from the glabella by shallow, obscure grooves; eyes opposite the mid-length of the glabella.

Raymond places the first species of Bathyurus in the family Dikelocephalidae, under a new genus *Platycolpus bubius,* and gives the following diagnosis of Lloydia Vogdes.

Whole animal oblong in outline; cephalon and pygidium regularly rounded, with elevated convex borders; cephalon convex; glabella usually tapering towards the front and reaching to the marginal border; glabella outlined by shallow or deep dorsal furrows; eyes small, near the dorsal furrows, and situated halfway to the front; facial sutures cut the posterior margin at the genal angles and the anterior margin in front of the eyes; genal angles usually without spines; thorax of 9 segments, pleura deeply grooved, ending in long, acute spines; pygidium with narrow axial lobe, which may have from 1 to 8 joints; pleural lobes smooth. The convex border which encircles the pygidium is set off by a shallow furrow.

Type *Bathyurus bituberculatus* Billings, which is common in the conglomerates at Point Levis near St. Joseph's Church, Beekmantown age.

The author also includes under Lloydia, Bathyurus Saffordi, which differs from the type, in lacking the basal lobes on the glabella; also *Bathyurus solitarius,* from Hare Bay, Newfoundland. *Lloydia oblongus* (Billings), similar to *L. saffordi,* but has straight sides to the glabella instead of tapering forward.

The author includes with doubt *Lloydia strenuus* Billings.

The illustration given by Billings, Pal. Fossils of Canada, p. 204, fig. 188, compares well with the type of Bathyurus.

Dr. Raymond places two species described by Billings as *Bathyurus quadratus* and *breviceps,* under a new genus Leiostegium, with the following diagnosis: General

RAYMOND (Percy E)—Continued

form elongate, oval; cephalon and pygidium, nearly equal, both rounded, smooth and convex; glabella quadrate, outlined by deep, narrow dorsal furrows and extending to the very narrow elevated anterior rim; fixed cheeks wide, eyes small and far from the glabella; thorax of 9 segments; pygidium almost semi-circular, unsegmented; axial lobe elevated, extending nearly the whole length. No concave border. Type *Bathyurus quadratus* Billings.

——— Notes on the ontogeny of *Isotelus gigas* DeKay.

Bull. Mus. Comp. Zoology Harvard College, vol. 58, No. 5, 1914, p. 247-263, with 3 plates.

The author gives the ontogeny of three Asaphids, namely, *Isotelus gigas, I. maximus* and *Basilicus barrandei.* Raymond remarks on:

I. Basilicus stage. The glabella is convex, narrowed behind, with a median tubercle and basal lobes. The brim is wide and horizontal; the cephalon semi-circular in outline; the genal angles produced into long spines; the axial lobe of the thorax is narrow; the pygidium has a prominent axial lobe, and the pleural lobes of the pygidium are ribbed.

II. Ogygites stage. The glabella soon becomes flattened and the facial sutures intermarginal, as in the adult of Ogygites.

III. Isotelus stage. The head and tail both become smooth and the axial lobe widens, as in the adult of Isotelus.

IV. *Isotelus gigas* stage. The head and tail becomes triangular and the spines are lost from the genal angles, a combination of characters distinguishing this species.

The author remarks in regard to *Isotelus Iowensis* Owen, that it is so closely allied to *I. gigas,* that where the two species occur together, as at Trenton Falls, it seems almost like hair-splitting to recognize two species. The adult *Isotelus iowensis,* has long genal spines extending to the 5th, 6th and 7th segments of the thorax.

Isotelus maximus Locke.

The author remarks that the common asaphids at Cincinnati are *Isotelus gigas, I. maximus, I. latus,* an undescribed species and one of the genus Onchometopus.

The four more common species of Isotelus in the Middle and Upper Ordovician are classed as follows:

A. Shield about three-fourths as long as wide.
   a. Adult without genal spines, shield subtriangular, *I. gigas.*
   b. Adult with genal spines, shield rounded, *I. iowensis.*

B. Shields less than three-fourths as long as wide, regularly rounded.
   a. Adult without genal spines, *I. latus.*
   b. Adult with genal spines, *I. maximus.*

The author places *Proetus spurlocki* Meek as a young Isotelus, probably that of *I. maximus.*

The article closes with a description of *Basilicus Barrandei* Hall, the author referring *Asaphus romingeri* Walc. and *A. wisconsensis* Walc. to the species, including *Ptychopyge ulrichi* Clarke, under the same.

——— Notes on the ontogeny of Paradoxides, with description of a new species.

Bull. Mus. Comp. Zoology Harvard College, vol. 58, No. 4, 1914, pp. 225-244, plates.

The author describes and illustrates *Paradoxides Harlani* Green, and a new species, under the name of *Paradoxides Hayzvardi,* with a Bibliography of the genus.

The author classes the genus after Ford into two groups:

A. With the second segment of the thorax prolonged beyond the others. To this group belong the Bohemian and South European species.

RAYMOND (Percy E)—Continued

B. A group of species, in which the second segment of the thorax is in no way distinguishable from the others. To this group belong the Scandinavian, British and American forms.

The author remarks that *Paradoxides Harlani*, differs from other species and one which makes it almost unique, in the wide, depressed brim at the anterior end of the cranidium.

—— New and old Silurian Trilobites from S. E. Wisconsin, with notes on the genera of Illaenidae.

Bull Mus. Comp. Zool., vol. 60, 1916, No. 1.

The author divides the Illaenoidae into two sections:

I. Illaenoidae.

Genera Illaenus, Thaleops, Dysplanus, Wossekia gen. nov. and Octillaenus, Bumastinae, Genera Bumastus, Actinolobus, Illaenoides.

Under Bumatus the author includes descriptions of the following species:

Bumastus cuniculus Hall, *B. Niagarensis* Whitf., *B. Dayi* nov., *B. decipiens* nov., *B. tenuis* nov., *B. insignis* Hall, *B. ioxus*, *B. graftonensis.*

M. & W. & B. *indeterminatus* Walc.

Under Eichwald's genus Actinolobus, he refers a single pygidium as *Actinolobus Americanus* from Racine Dolomite.

II. Lichadidae—The author refers Weller's *Dicranopeltis nasuta* to *Trochurus nasuta.*

Odontopleuridae—Ceratocephala goniata Warder, 1838.

Encrinuridae—Encrinurus reflexus nov.

The author refers to a new species a pygidium of large size, with 8 pairs of ribs on the lateral lobes, which he compares with other American species.

Calymmenidae—The author enumerates the following species:

Calymmene Niagarensis Hall, *C. breviceps* nov. for Hall's *C. Niagarensis*, 28th Rep. N. Y. State Cab. Nat. Hist., pl. 32, fig. 7-15.

Calymmene celebra nov. for Hall's *C. Niagarensis*, 20th Rep. N. Y. State Cab. Nat. Hist., p. 334, based on the pygidium which has 4 pairs of narrow ribs without impassed line, that reach only one-half way to the margin. New genus Liocalymene, with Vauxem's species *Hemicrypturus Clintoni* for its genotype. This form has a smooth pygidium without ribs and a jointed axis, from the Clinton of New York.

This genus should include the French and Spanish Silurian form described as *Calymmene Aragoi* by Rouault, which differs from *C. Salteri* described by the same author in having 10-11 joints on the axis, and *C. Arago* only 7.

Cheirurus Niagarensis Hall. The author restricts this species to Hall's species from Rochester, Pal. N. Y., vol. 2, p. 303, pl. 67, figs. 9-10.

Raymond refers the *Ceraurus insignis* Hall, Pal. N. Y., vol. 2, 1852, p. 300, pl. 6a, fig. 4, to *Cheirurus Welleri* nov. Also included Roemer's *C. bimucronata* Sil. Fauna, Tenn., p. 80, pl. 5, fig. 19, and Hall's *C. Niagarensis*, 20 Rep. N. Y. State Cab. Nat. Hist., pl. 21, figs. 10-11, and others.

Cheirurus dilatatus nov. for Hall's *Sphaerexochus Romingeri?* 28 Rep. N. Y. State Mus. Nat. Hist., 1877, pl. 32, fig. 16.

Cheirurus patens nov., *C. Tarquinius* Bill., *C. Hydei* Weller, and *C. nuperus* Bill.

The type of this species was lost and no further specimens have been described.

Sphaerexochus Romingeri Hall. The author remarks that the pygidium of this species is rare and usually incorrectly figured. The pygidium is entire, and the spine-figured by Hall are the ribs on the pleural lobes.

—— Beecher's classification of Trilobites after twenty years.

Am. Jour. Sci., ser. 4, vol. 43, 1917, p. 196-210.

RAYMOND (Percy E)—Continued

The author remarks on the order Hypoparia in Beecher's classification. Since the young of practically all primitive Trilobites lack eyes on the dorsal side, Beecher grouped all Trilobites in which absence of eyes was a primary characteristic in his First Order, Hypoparia. Recent studies and discoveries have led a number of investigators to the conclusion that blindness in the Agnostidae, Eodiscidae, Trinucleidae, Raphiophoridae and Harpedidae is secondary and a degenerative not primitive characteristic. If their position is well taken, then the order should disappear and the families be distributed in the two orders which remain.

The author gives a figure of *Agnostus nudus* exhibiting the facial suture and free cheeks. The facial sutures are not marginal, but intra-marginal. They meet in an obtuse angle at the front and run backward just inside the margin, somewhat like the course of the pre-ocular portion of the suture in an Homalonotus. The sutures keep within the angles, so that the fixed cheeks bear the genal angles—a Proparian characteristic. The sutures in this manner cut off a yoke-shaped area, bounded outside by the facial sutures and inside by a marginal edge, which follows the outline of the base of the elevated portion of the cranidium (the glabella). Both limbs of the yoke taper backward to a point, and it forms a continuous plate, with no vertical or epistomal sutures. This plate has the position and aspect of a large epistomal plate, but, whether called an epistoma or free cheek, the sutures which separate it from the cranidium must be interpreted as the facial sutures.

The author includes only one family under Hypoparia, that of Eodiscidae, Eodiscus as defined by Matthew, 1896, Mollisonia Walc. and Pagetia Walc. The discovery of *Pageria vootes* and *P. clytia,* which bear eyes very close to the lateral margins, seems to be a confirmation of the previous supposition that the Eodoscidae have ventral free cheeks.

Dr. Raymond does not note *Microdiscus caudatus* Delgado, a species with a mucronated pygidium and with free cheeks, from the Cambrian of Portugal.

Delgado's description, p. 349, pl. 3, fig. 12. Fauna Cambrian Haut Alemtejo.

Remarks: "La suture faciale, mais il semble que á partir de l'angle anterieur de l'oeil; il décrit une courbe tres courbe, ayant la convexité tournée en dehors, allant traverser le contour exterieur de la téte prés de la projection de l'oeil; postérieurement il décrit aussi une courbe analogue, atteignant le contour intérieur en dedans de la projection postérieure du centre de figure de l'oeil."

I would suggest the new genus Delgadoia for this species as a type.

Dr. Raymond remarks on Shumardidae, that these little trilobites are too much of a puzzle to be discussed at any length.

The paper ends in a discussion of Harpedidae and Trinucleidae.

The author would not include Orometopus in the last family, and remarks: "It is so unlike any of the Trinucleidae, that the burden of proof that it belongs to that family should be upon those who placed it there."

Under Raphiophoridae, a figure of *Lonchodomas portlocki* Barr., which shows on the ventral side of the head, a yoke-like plate similar to that of *Agnostus nudus,* but instead of being confined to the ventral side it laps over the margins up onto the dorsal side, being separated from the cranidium by a suture which has the course of the ordinary facial suture. The absence of eyes makes the analogy with the ventral plate of Agnostus the more complete.

Having reviewed all the families of the Hypoparia the author remarks that there seems to be a tendency in two directions—in Agnostus and Eodiscidae towards the Proparia, and in the Trinucleidae and Raphiophoridae towards the Opisthoparia.

Mesonacidae:

The author remarks there can be no doubt that *Elliptocephala asaphoides* and other

RAYMOND (Percy E)—Continued

species of this family show distinct traces of facial sutures, particularly of the part behind the eyes. He gives a figure of the head of a young species of *Elliptocephala asaphoides* Emmons.

In regard to the placing of Calymmenidae, Dr. Raymond follows that of Beecher and places it in the Order Proparia, because the post ocular portion of the facial sutures cut the genal angles in Pharostoma and the genal spines are borne by the fixed cheeks. The free cheeks are decidedly Proparian.

——— and **Barton** (Donald C.) A revision of American species of Ceraurus.

Bull. Mus. Comp. Zoology, vol. LIV, No. 20, 1913.

The authors state that the genus Ceraurus was proposed in 1832 by Green, for a new Trilobite which he describes as *Ceraurus pleurexanthemus*, and refer to Green's Monograph, 1832, p. 83.

The original description of this genus was first published in The Monthly Journal of Geology, June, 1832, p. 560, fig. 10, republished in the monograph.

Although the authors do not quote Corda, they take Reed's classification of Cheirurus into two groups on the form of the pygidae. The first with cyrtometopian pygidium like Ceraurus Green. The second like *Cheirurus insignis* type of pygidium with 3 pairs of subequal pleural spines and a short median spine.

The American species they class as follows:

Ceraturus bispinosus sp. nov.

Glabella or occipital segment strongly spinose with a pair of short, horn-like spines on the crest of the frontal lobe.

Ceraurus numitor Billings. A single medium spine on the neck segment.

Ceraurus mismeri Foerste. Glabella expanding rapidly forward. Genal angles with spines.

Ceraurus hudsoni Raymond. Glabella expanding forward; eyes more than one-half the length of the head; a small form glabella expansion 1 in 4.

Ceraurus pleurexanthemus Green. A medium-sized glabella expansion 1 in 7.

2. *Ceraurus milleranus* M. & G. Eyes one-half the length of the head from the posterior margin.

3. *Ceraurus dentatus* n. sp. Eyes less than one-half the length of the head from the posterior margin.

Ceraurus granulosus sp. nov Glabella with parallel sides.

The authors note in the Trenton fossils of *Ceraurus pleurexanthemus* Green, from the typical locality, that the pygidium varies on the posterior border with either aspinose and rounded border or with 2, 4 or 5 short spines or denticles.

The *Ceraurus dentatus* sp. nov.

The authors refer to Hall's *C. pleurexanthemus,* Pal. N. Y., vol. 1, p. 1847, pl. 65, figs. 1d, 1h, 1i, and pl. 66, figs. 1a-1g.

The *Ceraurus granulosus* sp. nov. is the *C. pompilius* Raymond, 7th Report, Geol. Vermont.

The *Ceraurus Milleranus* M. & G. is the *Calymmene bucklandi,* Anthony, 1839. (I would suggest the older name.)

The authors refer *Ceraurus rarus* Walcott to *Encrinurus Ceraurus pustulosa* Hall to *Eoharpes.*

To conform with the authors' reclassification, the authors remark that besides the species noted, that Vogdes' Catalogue, made in the year 1893, contains a number of other species, which do not belong to the genus as now restricted, as follows:

Cheirurus apollo Billings, to the genus Anacheirurus. *Cheirurus glaucus, C. satyrus* and *C. perforator* Billings, belong to Nieszkowskia (Schmidt subgenus of 1881).

RAYMOND (Percy E.) and BARTON (Donald C.)—Continued

Cheirurus vulcanus, C. prolificus and *G. mercurius* Billings.

The authors refer with doubt to Pseudosphaerexochus.

They refer *Ceraurus niagarensis* Hall, *Ch. tarquinius* Bill., *Ch. nuperus* Bill. and *C. hydei* Weller, to Cheirurus, though the last two show a curious parallel development in that they have a Ceraurus-like pygidium. (Then why divide the genus?)

Cheirurus sol the type of Raymond's genus Heliomera.

The author classes *Ch. polydrus* Bill. and *Ch. pompilus* Billings, under Ceraurinus Barton, a new genus.

— and Narraway (J. E.) A new American Cybele.

Annals of the Carnegie Mus., vol. 3, No. 4, 1906, pp. 597-602, fig.

Cybele Ella. n. sp.

The glabella described as *Glaphurus primus* Ann. Carnegie Mus., vol. 3, p. 362, belong to the genus Cybele. The Chazy form should be known as *Cybele prima*, and the name *Cybele valcourensis* should be eliminated.

Ravn (J. P. J.) Trilobitfaunaen i den bornholmske Trinucleusskifer Avec résumé en francais.

Danmark's Geologiske Undersogelse, II R., No. 10, 1899, pp. 49-62.

Primitia strangulata Salt. *Agnostus trinodes* Salt. *Trinucleus Wahlenbergi* Rouault, *T. Bucklandi* Barr. ? *Ampyx Portlocki* Barr., *A. gratus* Barr. *Dionide euglypta* Ang. *Remopleurides radians* Barr. *Calymene* sp. *Asaphus (Ptychopyge) nobilis* Barr. *Illaenus leptopleura* Linrs. *Illaenus Angelini* Helm. *Illaenus* sp., *I. (Panderia) megalophthalmus* Linrs. *Phacops recurvus* Linrs. *Cheirurus insignis* Beyr. ? *Pseudopharexochus laticeps* Linrs. *Cybele* sp. *Dindymene ornata* Linrs. *Acidaspis (Cyrtometopus?) decacantha* Ang. *Phillipsia parabola* Barr.

Redlich (K.) The Cambrian Fauna of the Eastern Salt range.

Memoir Geol. Survey India, new series, vol. 1, No. 1, 1899, pp. 1-13, plate.

Hoeferia noetlingi n. gen. et sp. (non Hoeferia Bittner Moll. 1895.)

Dr. Redlich compares this form with the genera *Protolenus, Paradoxides* and *Metatoxides*.

The genus is now referred to *Redlichia*, Crossman, see Rev. Critique Pal., 1902, sixieme Ann., p. 52.

Reed (F. R. Cowper). Woodwardian Museum Notes. On *Phacops (Chasmops) Marri*.

Geol. Mag. London, Decade iv, vol. 1, 1894, p. 241.

——— Woodwardian Museum Notes. New Trilobites from the Bala beds of the County Waterford.

Geol. Mag. London, Decade iv, vol. 8, 1895.

Cybele Tramorensis n. sp.

Trinucleus hibernicus nov.

——— The fauna of the Keisley Limestone.

Quart. Jour. Geol. Soc. London, vol. 52, 1896, pp. 407-437, plates.

Agnostus cf. *galba* Bill. *Ampyx binodulosus* n. sp. *Tiresias insculptus* McCoy.

Remopleurides Colbii Portl., *R. longicostatus* Portl. *Cyphoniscus socialis* Salt. *Calymmene Blumenbachi* var. *Caractaci* Salt.

Illaenus Bowmani Salt., also var. *brevicapitatus* and *longicapitatus*. *Illaenus fallax* Holm., *I. Roemeri* Volb., *I. caecus* Holm., *I. galeatus* n. sp.

REED (F. R. Cowper)—Continued

Cheirurus bimucronata Murch. var. a *C. cancrurus* Salt., *C. Keisleyensis* n. sp., *C.* cf. *glaber* Ang., *C.* cf. *clavifrons* Dalm. ? *C. (Pseudosphaerexochus) conformis* Ang., *C. (P.) subquadratus* n. sp.

Sphaerocoryphe granulata Ang. *Sphaerexochus mirus* Beyr., *S. latirugatus* n. sp. *Staurocephalus Murchisoni* Barr.

Acidaspis convexa n. sp. *Lichas laxatus* McCoy, *L. affinis* Ang., *L. conformis* Ang. var. *Keisleyensis, L. Hibernicus* Portl., *L. bifurcata* n. sp., *L. bulbiceps* Phil. MS.

Cyphaspis ? Harkessi n. sp., *C. (Tornquistia)* n. subgen. *Nicholsoni* n. sp.

Phillipsinella parabola Barr. *Harpes Wegelini* Ang., *H. costatus* Ang.

Harpes species a-b.

——— Woodwardian Museum Notes. On the evolution of the genus Cheirurus.

Geol. Mag. London, Decade iv, vol. 3, 1896, pp. 117-123 and pp. 161-167.

The author arranges the genus Cheirurus as follows:

1. Cheirurus (Anacheirurus) type, *C. Frederici* Salt. Cambrian.

The Tremadoc species has 11-12 thoracic segments, each of which is deeply grooved along its middle. Pygidium has 4 rings and 3 short pleural lobes on each side, which are grooved throughout and extend over the margin into spines.

2. Cheirurus (Eccoptocheile) type, *C. claviger* Beyrich. Ordovician.

Glabella oval, often much inflated. Thorax 10 segments, grooved imperfectly.

3. Cheirurus (Cyrtometopus) type, *clavifrons* Dalm. Ordovician-Silurian.

4. Cheirurus (Hemisphaerocoryphe) type, *pseudo-hemicranium*, Nieszk. Ordovician.

The basal lobes of the glabella are separated by a strong glabella, side furrow joining the neck furrow. These lobes are less elevated than the rest of the glabella.

5. Cheirurus (Sphaerocoryphe) type, *S. cranium* Kutorga. Ordovician.

6. Cheirurus (Nieszkowskia) type, *cephaloceros*, Nieszk. Cambrian and Ordovician.

7. Cheirurus (Pseudosphaerexochus) type *hemicranium* Kutorga. Ordovician.

The characteristics of the above two genera are 12 thoracic segments and the presence of a longitudinal row of puncta instead of a furrow on the inner portion of each pleura.

8. Cheirurus (Group 1 with cyrtometopian pygidium) type, *C. Exsul* Beyr. Ordovician-Silurian.

In this group the anterior pleura of the tail are enlarged and project behind the posterior ones.

Barton refers this group to Ceraurus.

9. Cheirurus Group 2 type *C. bimcronatus* Murch. Ordovician-Silurian.

In this group the pygidium has 3 pair of pleura with free ends. The fourth pair are represented by a single medium terminal piece.

Barton refers this group to Cheirurus.

10. Cheirurus (Crotalocephalus type, *C. articulata* Münster. Devonian.

This genus is almost entirely restricted to the Devonian. The important subgeneric characteristics are the continuous first and second side furrows of the glabella, the triangular basal lobes, which nearly or quite meet in the centre of the glabella at their apices, and the nearly straight obliquely directed third side furrows.

——— *Trinucleus seticornis.*

Geol. Mag. London, Decade iv, vol. 4, 1897, pp. 427-428.

REED (F. R. Cowper)—Continued

——— Fossils from the Grey shales marked on the map as Trilobite shales.

Quart. Jour. Geol. Soc. London, vol. 53, 1897, p. 538.

Trinucleus seticornis His. var. *portrainensis* n. var.

——— Notes on the Geology of the County Waterford.

The fauna of the Ordovician beds near Tramore.

Geol. Mag. London, Decade iv, vol. 4, 1897, pp. 502-512. List of fossils.

——— Notes on the affinities of the genera of Cheirurus.

Geol. Mag. London, Decade iv, vol. 5, 1898, pp. 206-214.

——— Blind Trilobites.

Geol. Mag. London, Dec. iv, vol. 5, 1898, pp. 439-447, and 493-506.

The author divides the Blind Trilobites into two divisions as follows:

Group 1—Primitive forms.

Agnostus Cambrian—Ordovician.
Microdiscus Cambrian.
Trinucleus Ordovician.
Ampyx Ordovician-Silurian.
Dionide Ordovician.
?*Salteria* Ordovician.
Endymionia Ordovician.
Tiresias Ordovician.
Conocoryphe s. str. Cambrian.
Ctenocephalus Cambrian.
Erinnys Cambrian.
Carausia Cambrian.
Dictyocephalites Cambrian.
Eryx Cambrian.
Aneucanthus Cambrian.
Anopocare Cambrian.
?*Avalonia* Cambrian.
?*Bathynotus* Cambrian.
Carmon Ordovician.
Holocephalina Cambrian.
?*Telephus* Ordovician.
Dindymene Ordovician.
Areia Ordovician.
Placoparia Ordovician.
Prosopicus.
Isocolus Ordovician.
Typhloniscus, Lower Devonian.
?*Cyphoniscus* Ordovician.
Conophrys probably—Ordovician.
Shumardia larval forms—Ordovician.

Group 2—Adaptive forms.

Harpes benignensis Barr., Etage Dd. 1.
Illaenus Angelini Holm.
—*aratus* Barr., Etage Dd. 1.
—*caecus* Holm., Keisley Limestone.
—*galeatus* Reed, Keisley Limestone.
—*Katzeri* Barr., Etage Dd. 1.
—*leptopleura* Linnars., Trinucleus Beds.
—*Zeidleri* Barr., Etage Dd. 5.
Proetus dormitans Richter, Tentaculites Beds.
Proetus expansus, Tentaculites Beds.
Acidaspis myops Richter, Tentaculites Beds.
Phacops (Trimerocephalus) laevis, Münst. Upper Devonian.

The genera Dindymene Typhloniscus and Carmon the author places with some hesitation in Group 1, which may be regarded as reversionary or degenerate types on account of their primitive adult cephalic features, combined with morphological characters.

The genera Salteria, Avalonia, Bathynotus, Telephus and Cyphoniscus may be ultimately found to possess eyes.

REED (F. R. Cowper)—Continued

——— Woodwardian Museum Notes. A new Carboniferous Trilobite.

Geol. Mag. London, Decade iv, vol. 6, 1899, pp. 241-245, plate.

Phillipsia cracoensis n. sp.

——— Woodwardian Museum Notes. A new Trilobite from Mount Stephen Field, B. C.

Geol. Mag. London, Decade iv, vol. 6, 1899, pp. 358-361, figure.

Oryctocephalus Reynoldsi n. sp.

——— The Lower Palæozoic bedded rocks of County Waterford.

Quart. Jour. Geol. Soc., London, vol. 55, 1899, pp. 718-772, pl. 49.

Asaphus Haugtoni n. sp. *Cybele Macheneryi* n. sp., *C. sex-tuberculata* n. sp. *Encrinurus fallax* n. sp. *Illaenus Davisi* var. *pseudolimbatus* n. sp. *Remopleurides Portlocki* n. sp., *R. Saltéri* n. sp., *R. tuberculatus* n. sp. *Tramoria punctata* n. sp.

The author abandons this genus and refers the species to *Apatokepalus punctatus*, Geol. Mag., Dec. 4, vol. 7, p. 46, 1900.

——— Woodwardian Museum Notes. On the British species of the genus Conocoryphe.

Geol. Mag. London, Decade iv, vol. 7, 1900, pp. 250-257.

The genus Conocoryphe sens. str., is confined in Britain to the Lower and Middle Cambrian beds.

The author reclassifies the species as follows:

Euloma abdita Salt. *Solenopleura applanata* Salt. *Olenus ? bucaphalus* Belt. *Conocoryphe (Bailiella) bufo* Hicks. *Ctenocephalus coronatus* Barr. *Solenopleura ? depressa* Salt.

The *C. ? ecorne* Ang. Salter, Cat. Camb. Sil. Foss., p. 12, is a species of *Peltura*.

Conocoryphe ? Homfrayi Hicks. *Olenoides humerosus* Salt. *Apatokephalus invitus* Salt. *Olenus (Parabolinella?) longispina* Belt. *Conocoryphe Lyelli* Hicks. *Peltura ? malvernia* Phillips. *Euloma monile* Salt. *Conocoryphe ? perdita* Hicks. *Olenus (Parabolinella) Planti* Salt. *Olenus (Cyclognathus) simplex* Salt. *Ctenocephalus (Hartella) solvensis* Hicks. *Solenopleura ? variolaris* Salt. *Angelina verisimilis* Salt. *Olenus (Parabolinella?) Williamsoni* Belt.

——— Woodwardian Museum Notes. Salter's undescribed species.

Geol. Mag. London, Decade iv, vol. 7, 1900, pp. 303-308, plate.

Olenus (Parabolinella) Planti Salter, Cat. Camb. Sil., Foss, p. 11.

Olenus (Ctenopyge) expansus Salt., *ibid.*, p. 12.

Neseuretus recurvatus (Hicks) Salter, Cat. Camb. Sil., Foss, p. 22.

Neseuretus quadratus (Hicks) Salter, Cat. Camb. Sil., Foss, p. 22.

Neseuretus sp. *(Homalonotus monstrator)* Salter, Cat. Camb. Sil., Foss, p. 22.

— Woodwardian Museum Notes. Salter's undescribed species No. 2.

Geol. Mag. London, Decade iv, vol. 8, 1901, pp. 5-14, plate.

Lichas scutalis Salter MSS. *Proetus Fletcheri* Salt., Cat. Camb. Sil., Foss, p. 134 (a 825, a 828).

—— Woodwardian Museum Notes. Salter's undescribed species No. 3.

Geol. Mag. London, Decade iv, vol. 8, 1901, pp. 106-110, plate.

Phacops (Odontocheile) caudatus var. *corrugatus* Slater.

Encrinurus multiplicatus Salt., Cat. Camb. Mus. Sil., Foss, p. 51.

REED (F. R. Cowper)—Continued

— — Notes on the genus *Lichas*.

Quart. Jour. Geol. Soc. London, vol. 58, 1902, p. 50.

The author classifies the Lichadidae into two groups as follows:

Group 1—Protolichas:

Sec. A. Corydocephalus type *L. plamatus* Barr.
—B. Dicranopeltis type *L. scaber* Beyr.
—C. Platylichas type *L. margaritifer* Nieszk.
—D. Metopolichas type *L. verucosus* Eichw.
—E. Metalichas type *L. cicatricosus* Schm.
—F. Uralichas type *L. Ribeiroi* Delg.
—G. Ceratarges type *L. armatus* Goldf.
—H. Oncholichas type *L. ornatus*.

Group 2—Deuterolichas:

Sec. A. Hopolichas type *L. tricuspidatus* Beyr.
—B. Homolichas type *L. angustus* Beyr.
—C. Conolichas type *L. aequiloba* Steinh.
—D. Echinolichas type *L. Eriopis* Hall.
—E. Leiolichas type *L. illaenoides* Nieszk.
—F. Paralichas type *L. dalecarlicus* Ang.
—G. Terataspis type *L. grandis* Hall.
—H. Ceratolichas type *L. gryps* Hall.

The classification is based on (1st) a group with a pair of bi-composite lateral lobes to the glabella, and a more or less definite fourth pair of lateral lobes; (2nd) a group with a pair of tri-composite lateral lobes, originating by the fusion of the fourth pair, with the bi-composite pair of the preceding group.

——— Woodwardian Museum Notes. *Brachymetopus Strzeleckii* McCoy.

Geol. Mag. London, Decade iv, vol. 10, 1903, pp. 193-197, figure.

The author remarks (on p. 196): "It seems open to question, whether the European species of Brachymetopus should not be regarded as constituting a distinct group or subgenus, for which the name Brachymetopina may be suggested."

——— The Lower Palæozoic Trilobites of the Girvan District, Ayrshire.

Palaeontological Society London, Part 1, pp. 1-48, plates 1-6, December, 1903.
Part 2—pp. 49-96, plates 7-13, December, 1904.
Part 3—pp. 97-186, plates 14-20, December, 1906.

List of the species:

Agnostidæ—*Agnostus agnostiformis* McCoy, *A. girvanensis* n. sp., *A. perrugatus* Barr., *A. tardus* Barr.

Harpedidæ—*Harpes Flanagani* Portl.? *H.* sp. (a) to (c).

Trinucleidæ—*Trinucleus Bucklandi* Barr., *T.? Maconochiei* Eth. & Nich., *T. subradiatus* n. sp., *T.* sp. ind. (a) to (g). *Ampyx depressus* Ang., *A. Drummuckensis* n. sp., *A. Hornei* Eth. & Nich., *A. incurvus* n. sp., *A. Macallumi* Salt., *A. mammillatus* var. *Austini* Portl.? *A.* cf. *foveolatus* Ang., *A.* cf. *scanicus* Ang. *Dionide Lapworthi* Eth. and Nich., *D. Richardsoni* n. sp.

Olenidæ—*Triarthrus Becki* Green? *Apatokephalus* sp. *Remopleurides Barrandei* Eth. and Nich., *R. (Teratorhynchus) bicornis* n. sp., *R. Colbii* Portl.? *R. correctus* n. sp., *R. dorsospinifer* Portl., *R. longicostatus* Portl., *R. Salteri* Reed *girvanensis* var. nov., *R.* cf., *nanus* Leucht., *R.* cf., *platyceps* McCoy. *Shumardia scotica* n. sp. *Salteria primaeva* Wyv. Thom. *Telephus fractus* Barr.

REED (F. R. Cowper)—Continued

Asaphidæ—*Asaphus (Isotelus) gigas* DeKay ? *A. Isotelus instabilis* n. sp., *Asaphus* sp. *Stygina latifrons* Portl. *Cyclopyge armata* Barr., *C. rediviva* Barr., *C.* cf. *gigantea* Barr. *Bohemilla* sp. *Illaenus aemulus* Salt., also var. *I. balclatchinensis* n. sp., *T. Barriensis* Murch., *I. Bowmani* Salt ? and var. *longicapitatus* Reed, *I. Davisi* Salt., *I. extensus* n. sp., *I. latus* McCoy, *I. Macallumi* Salt., *I. memorabilis* n. sp., *I. Murchisoni* Salt. ? *I. nexilis* Salt., *I. Portlocki* Salt., *I. shallochensis* n. sp., *I. Thomsoni* Salt., *I.* cf. *oculosus* Holm., *I.* cf. *perovalis* Murch. *Illaenus* sp.

Proetidæ—*Proetus girvanensis* Eth. and Nich., *P. latifrons* McCoy, *P. procerus* Eth. and Nich., *P. pseudolatifrons* n. sp., *P. Stokesi* Murch., *P.* cf. *obconicus* Lindstr., *Proetus* sp. *Cyphaspis megalops* McCoy. *Arethusina Konnincki* Barr. ? *Phillipsinella parabola* Barr. *Menocephalus ? (Tornquistia)* cf. *Nicholsoni* Reed.

Bronteidæ—*Bronteus Andersoni* Eth. and Nich., *B. craigensis* n. sp., *B. Grayi* n. sp. *Bronteus* sp. ind. (a) and (b). *Bronteopsis ardmillanensis* n. sp., *B. scotia* Salt.

Lichadidæ—*Lichas (Corydocephalus) anglicus* Beyr.
Lichas (Corydocephalus) Geikei Eth. and Nich.
Lichas (Corydocephalus) scutalis Salt.
Lichas (Corydocephalus) cf. *Wesenbergensis* Schm.
Lichas (Platylichas) Grayi Fletch., also var. *scoticus.*
Lichas (Platylichas) laxatus McCoy.
Lichas (Metopolichas) bulbiceps Phill. var. aff. *marginatus* Lindstr.
Lichas (Amphilichas) hibernicus Portl.
Lichas (Conolichas) cf. *aequiloba* Steinh. also sp. ind. (a).
Lichapyge ? problematica n. sp.

Acidaspidæ—*Acidaspis Barrandei* Fletch. and Salt., *A. callipareos* Wyv. Thom., *A. coronata* Salt., *A. deflexa* Lake, *A. Grayae* Eth., *A. hystrix* Wyv. Thom., *A. lalage* Wyv. Thom., *A. dalecarlica* Tornq.

Encronuridæ—*Encrinurus punctatus* Brunn var. *calcareus, arenaceus.*
Encrinurus multisegmatatus Portl. *Cybele* cf. *aspera* Linnrs., *C. bellatula* Dalm., *C. Loveni* Linrs. var nov. *girvanensis, C. verrucosa* Dalm., *C.* sp. ind. (a) and (b). *Dindymene cordai* Eth. and Nich.

Calymmenidæ—*Calymmene Blumenbachi* Brong. also var. *drummuckensis, C. cambrensis* Salt., *C. planimarginata* n. sp., *C.* sp. ind. (a) and (b).

Cheiruridæ—*Cheirurus bimucronatus* Murch., *C. gelasinosus* Portl., also var. *Cheirurus (Cyrtometopus) octolabatus* McCoy, *C. (Nieszkowskia) unicus* Wyv. Thom., *C. (Sphaerocoryphe) Thomsoni* n. sp., *C. (Youngia) tripinosus* Young. *Cheirurus* sp. (a) and (b). *Deiphon Forbesi* Barr. *Sphaerexochus mirus* Beyr. *Staurocephalus globiceps* Portl. *Pliomera* sp.

Phacophidæ—*Phacops (pterygometopus) Brongniarti* Portl.
Phacops (Phacopidella) Downingiae Murch.
Phacops (Phacopidella) elegans Sars and Boeck.
Phacops (Chasmops) Bisetti n. sp.

——— Sedgwick Museum Notes. New fossils from the Haverfordwest District.

Geol. Mag. London, Decade v, vol. 1, 1904, pp. 106-109, plate.
Phacops Robertsi n. sp.

REED (F. R. Cowper)—Continued

——— Sedgwick Museum Notes. New fossils from the Haverfordwest District. No. 2.

Geol. Mag. London, Decade v, vol. 1, 1904, pp. 383-388, plate.

Phacops (Dalmanites) socialis Barr. var. *P. (Dalmanites)* aff. *incertus* Deslong. *Phacops (Chasmops) conicophthalmus* Boeck. *Phacops (Chasmops) macroura* Sjogren. *Encrinurus multisegmentatus* Portl.

——— Sedgwick Museum Notes. New fossils from the Haverfordwest District. No. 3.

Geol. Mag. London, Decade v, vol. 2, 1905, pp. 97-104, plate.

Harpes sp.— *Ampyx* cf. *rostratus* Sars. *Remopleurides Salteri* Reed var. *girvanensis*. *Cyphaspis megalops* (McCoy), *C.* cf. *Harknessi* Reed. *Acidaspis (Ceratocephala) Turnbulli* nov., *A. (C.) sladensis* nov. *Lichas (Metopolichas) affins* Ang. var., *L. (M.) laciniatus* Dalm ? *L. (Platylichas) margiritifer* Nieszk. var. *Cheirurus (Pseudosphaerexochus)* aff. *subquadratus* Reed.

——— The classification of the genus Phacopidæ.

Geol. Mag. London, Decade v, vol. 2, pp. 171-178 and 224-228.

The author classifies the genus as follows:

1. Sub-family Dalmanitinae subgenera Dalmanitina:

SYNPHORIA.
- Dalmanites sens str. Haumanannia.
- Asteropyge.
- Odontocephalus.
- Corycephalus.
- Malladaia.
- Coronura.
- Probolium.
- Cryphina.

2. Sub-family phacopinae. 2—Genus Phacops, subgenera Phacopidella:
   - Phacops sens str.
   - (Somatrikelon).
   - Trimerocephalus.
3. Sub-family Pterygometopinae, Genus Pterygometopus:
   - Subgenera Pterygometopus sens st.
   - Chasmops.
   - Homalops.
   - Monorakos.

—— - Sedgwick Museum Notes. Crustacea from Girvan.

Geol. Mag., Decade v, vol. 4, 1907, pp. 108-115, plate iv.

Anatifopsis balclatchiensis n. sp. *Pinnocaris curvata* n. sp. *Solenocaris solenoides* Young. *Ceratiocaris (Solenocaris?)* sp. *Helminthochiton Grayiae, H. Woodw. Chiton* sp.

——— Sedgwick Museum Notes. A new species of Lichas.

Geol. Mag., Decade v, 1907, vol. iv, pp. 396-400, plate xvii.

Lichas (Homolichas) melmerbiensis n. sp.

——— New fossils Heverfordwest.

Geol. Mag., Decade v, vol. v, 1908, pp. 433-436, pl. xiv.

Typhloniscus princeps n. sp.

The only species of this genus previously described was *T. Baini* Salter, from South Africa.

REED (F. R. Cowper)—Continued

——— A new species of Cyclus from the Carboniferous Limestone of Ireland.

Geol. Mag., Decade v, vol. v, 1908, pp. 551-552.

Cyclus simulans n. sp.

——— On *Phacops Weaveri*, Salter.

Geol. Mag., Decade v, vol. vi, 1909, p. 69.

Refers only the *Phacops Weaveri* Salt. Mong. Brit. Tril., plate iv, fig. 7, from Llandovery rocks of the Tortworth area.

——— – Rocks of the Toumakeady District. Vii Palæontological Appendix.

Quart. Jour. Geol. Soc. London, vol. 65, 1909, pp. 151-152, pl. 6.

Illaenus Weaveri n. sp. closely resembles, *I. esmarkii* Schloth., *I.* aff. *chudleighensis* Holm., *Pliomera* aff. *Fischeri* Eichw., *P.* aff. *Barrandei* Billings.

Cybele connemarica n. sp. Encrinurus sp.

The author compares *E. varicostatus* Walc., and *E. annulus* Clarke. It differs in the shape of the pygidium and course of the lateral ribs. Acidaspis sp. Apatocephalus sp. ? and *Telephus hibernicus* n. sp. also Symphysurus ? sp.

——— - The Cambrian fossils of Spiti.

Memoirs Geol. Sur. of India, ser. xv, vol. 7, Memoir No. 1, Calcutta, 1910, 76 pp., plates 1-6.

The author describes the following species of Trilobites:

Agnostus spitiensis n. sp.

There are considerable affinities between this species and *A. acadicus* Hartt, also with *A. montis* Matthew.

Microdiscus: The author uses *M. punctatus* Salter for the type of the genus and not *M. quadricostatus* Emmons, certainly the young of the Trinucleus from the Hudson River group; and remarks, "Should *Pemphigaspis hullata* Hall, prove to belong to this genus, this name will have to be adopted as Emmons founded his genus Microdiscus on a young of another genus."

Matthew Trans. N. Y. Acad. Sci., 1896, p. 236, remarks, as a general rule, in the genus Microdiscus the number of rings in the axis of the pygidium increase according to the geological age of the species. The majority of those of the Olenellus zone have but few rings (4 to 6), but in the Paradoxides zone species with many rings (8 to 10, even 12) are multiplied.

He divides the genus into four Sections: With long glabella—Section 1, Lobatus; Section 2, Speciosus. With short glabella—Section 3, Dawsonia; Section 4, Eodiscus.

The following Himalayan species are described and illustrated:

Microdiscus Griesbachi sp. nov. The species agrees in general characters with *M. connexus* Walcott, *M. haimantensis* sp. nov. *Redlichia Noetlingi* Redlich.

The author remarks that this species is very closely related to *R. nobilis* Walcott. Indeed, it seems difficult to separate the new Chinese species *R. chinensis* Walcott, *R. finalis* Walcott and *R. nobilis* Walcott, by any strongly marked and constant features from the Indian species.

Zacanthoides indicus sp. nov. *Oryctocephalus Salteri* sp. nov., *O.* cf. *Reynoldi* Reed.

Under the genus Ptychoparia, Corda, 1847, the author remarks:

There has been extraordinary diversity in the use of the generic name Ptychoparia, and in spite of the recent efforts of palæontologists to bring order out of chaos it cannot be said that uniformity of usage prevails at the present date.

REED (F. R. Cowper)—Continued

He also remarks with regard to Ptychoparia that there happily cannot be any dispute as to the type of the genus, for Corda's first described species, *Ptychoparia striata* Emmrich, is well known and universally acknowledged.

Reed quotes Corda's original description of the genus and remarks that Pompeckj agrees with this strict limitation of the generic name Ptychoparia, but instead of regarding it as a subgenus of Conocephalites, as Wallerius did, prefers to place the latter as a subgeneric division of the genus, which is followed by the author with *C. Emmerichi* Barrande, as a type.

With regard to the genus Liostracus Angelin, the author quotes Matthew's divisions of the genus Ptychoparia and Liostracus, and remarks that the only constant differentiating feature of value is the shape of the genal angle, spined or rounded.

Matthew takes *L. aculeatus* as a type, but Brögger is followed by Wallerius in regarding the genal angles as typically spined, as in *L. costatus* Angelin. Reed places the genus as a subgenus to Ptychoparia.

Also Conocephalites, with *C. Emmrichi* Barrande, as a type. The leading characteristics of it are: 1—the long narrow eyes; 2—the position of the eyes near the glabella; 3—the course of the facial sutures, which behind the eyes run out almost horizontally before bending back; 4—the furrow on the eye lobes; 5—the absence of occular ridges; 6—the flat border.

The author describes *Ptychoparia spitiensis* sp. nov., *P. Stracheyi* sp. nov., *P. urceolata* sp. nov., *P. consocialis* sp. nov., *P. admissa* sp. nov., *P. pervulgata* sp. nov., *P. maopoensis* sp. nov., *P. defossa* sp. nov. *Ptychoparia (Liostracus)civica* sp. nov.

Subgenus Conocephalites: *Ptychoparia (Conocephalites) memor* sp. nov., *P. (C.) hesterna* nov. sp.

Subgenus *A. Ptychoparia hostilis* sp. nov., *P. praeterita* sp. nov.

Subgenus *B. Ptychoparia himalaica* sp. nov.

Bathyuriscus Stoliczkai sp. nov.

Dicellocephalus interpres sp. nov. *The author* compares it with *D. Dewinei* Billings and other species, remarking that *D. Dewinei* and *D. Hisingeri* of Billings cannot rightly be retained in the genus Dicellocephalus.

Genus Agraulos Corda, *A.* aff. *Roberti* Matthew, *A. simulans* sp. nov., *A. ? fervidus.*

Anomocare Angelin, 1854, *A. conjunctiva* sp. nov.

The peculiar course of the marginal furrow, so as to make a broad V in front of the glabella, occurs also in several species attributed to Ptychoparia, *P.* sp. *ind.* Walcott, from Yellowstone, and *P. teucer Billings.* The author compares *A. Angelini* Grönwall. Anomocare sp.

Schantungia Lorenz, 1906, *S.* cf. *frequens* Dames.

Reed remarks, that unfortunately the name Schantungia is apparently preoccupied, Walcott having employed it for a type of trilobites from China in 1905, but without a figure. If it is proved that the type of Walcott's Shantungia and Lorenz's Schantungia belong to different genera a new name must be given to this group or genus containing Dames' *C. frequens.*

Olenus haimantensis sp. nov.

The author compares *O. attenuatus* Boeck.

——— Palæontological Notes.

The Ordovician of the Glensaul District by C. I. Gardiner and S. H. Reynolds.

Quart. Jour. Geol. Sec. London, vol. 66, 1910, pp. 271-278, plates 20-2

The author describes *Illaenus Weaveri* Reed, *Niobe* sp. *Nileus armadillo* Dalman. *Bathyurellus glensaulensis* sp. nov.

This genus has not been previously recorded from the British Isles.

REED (F. R. Cowper)—Continued

The author compares *B. formosus* Bill., *B. expansus* Bill. and *B. brevispinus* Raymond. *Bathyurus* cf. *Timon* Bill., *B.* aff. *nero* Billings.

Pliomera pseudoarticulata Port. *Encrinurus octocostatus* sp. nov. *Phacop (Chasmops)* aff. *Odini* Eichwald.

——— Sedgwick Museum Notes. *Dionide atra*, Salter.

Geol. Mag., Decade 5, No. 5, vol. 9, p. 200, plate 11.

The author includes the *Trinucleus Ramsayi* Hick., 1875, under this species. The author remarks the many points of affinity possessed by the head shield with other genera, indicate the intimate relations of Dionide with Harpes, Harpides and Erinnys.

——— New fossils from the Dufton Shale.

Geol. Mag., Decade v, vol. 7, No. 5, 1910, p. 211, plates 16 and 17.

Trinucleus Nicholsoni sp. nov.

The author remarks: *T. ornatus* (Sternb.) Barrande seems closely allied to our Dufton species in the shape of the head shield, nuchal spine, pits in axial furrows, tubercle on glabella, and radial arrangement of the pits on the fringe, but these pits are more numerous and smaller.

Acidaspis semievoluta sp. nov. *Homalonotus ascriptus* sp. nov.

Ostracoda: *Beyrichi (Ceratopsis) duftonensis* sp. nov., *B. (Ctenobolbina)* ? *superciliata* sp. nov., *B. (Tetradella) Turnbulli* sp. nov.

——— Sedgwick Museum Notes. On the genus Trinucleus.

Geol. Mag. Decade v, vol. 9, p. 346, pl. 18, 1912.

The author discusses the fringe of Trinucleus, the double nature of the fringe, the character of the pits, arrangement of the pits. Difference in the upper and lower surfaces of the fringe, the outer and inner bands and the position of the girder.

The plate illustrates *Trinucleus concentricus* Eaton, *T. hibernicus*, *T. fimbriatus* Murch., *T. seticornis* His., *T. Nicholsoni* Reed, *T. subradiatus* Reed, *T. favus* Salter and *T. Murchisoni* Salter.

——— Sedgwick Museum Notes. On the genus Trinucleus.

Geol. Mag., Decade 5, vol. 9, pp. 385-394, pl. 19, part 2, 1912.

The author figures the upper and lower surface of fringe of five species of the genus Trinucleus.

Trinucleus hibernicus Reed, *T. fimbriatus* Murch., *T. Murchisoni* Salter, *T. Nicholsoni* Reed and *T. seticornis* Hisinger.

Reid (James) and **Macnair** (Peter). On the genera Psilophyton, Lycopodites, Zosterophyllum and Parka decipiens of the Old Red Sandstone of Scotland, their affinities and distribution.

Trans. Edinb. Geol. Soc., vol. 7, 1899, pp. 368-380.

Remelé (A.) Zwei neue Trilobiten aus undersilurischen Diluvial Geschieben von Eberswale.

Zeitschr. Deutsch Geol. Ges., vol. 37, 1885, p. 1032.

Rhinaspis erratica n. sp. and subgen. of Meglaspis.

Hydrocephalus Hauchecornei gen. et sp. nov. of Ampyx.

Remes (M. Poznamky). Trilobitech Celechovského Devonu.

Prostejove, 1913.

The author describes *Bronteus granulata* Goldf. *Lichas* cf. *armata* Goldf. *Cyphaspis ceratophthalmoides* Rud. Richter. *Proetus moravicus* Smycka. *Schizoproetus celechovicensis* Smycka (emend Rud. Richter).

REED (F. R. Cowper)—Continued

Dechenella subgen. Eudechenella n. gen.

Dechenalla (Eudechenella) rittbergensis. H. Zimmermann emend Rud. Richter.

The author illustrates *Cyphaspis ceratophthalmoides* Rud. Richter.

Reynolds (S. H.) Certain fossils from the Lower Palæozoic rocks of Yorkshire.

Geol. Mag. Decade iv, vol. 1, 1894, p. 108, plate 4.

The author illustrates *Staurocephalus* cf. *Murchisoni* Barr.—a pygidium. *Dindymene Hughesiae* Roberts MS., entire figure.

The author compares the new species with *D. ornata* Linrs., *D. Frederici Augusti* Barr., *D. Haidingeri* Barr and *D. Cordai* Eth. and Nich., remarking the differences in the number of large tubercles on the glabella in each and the new form.

Richter (Reinard) and **Unger** (Franz). Beitrag zur Paläontologie des Thuringer Waldes.

K. Akad. der Wissench. mathem. naturw Bd. cixi, 1856.

Cytherina: *Phacops ? granulatus* Münster. *Calymene marginata* Münster, *C. furcata* Münster.

Phacops cryptophthalmus Emm., *P. macrocephalus* Richter, *P. mastophthalmus* Richter Phacops sp.

Dalmanites punctata Steininger, Cylindraspis sp., *C. latispinosa* Sandb. Pygidium. ?

Cypridina serrato-striata Sandb., *C. globulus* Richter, *C. gyrata* Richter, *C. taeniata* Richter, *C. calcarata* Richter.

Richter (Rudolf). Beiträge zur Kenntnis devonischer Trilobiten aus dem Rheinischen Schiefergebirge Vorbericht zu einer Monographie der Trilobiten der Eifel. Dissert. Marburg, 1909.

The author describes *Proetus Cuvieri* Steininger, 1831, including two var. *laevigata* Goldf. and *granulosa* Goldf. *Proetus cornutus* Goldf., referring *Proetus Holzapfeli* to the species. *Proetus tenuimargo* nov. for *P. cornutatus* Beyr. non Goldf. *Proetus (Tropidocoryphe) filicostus* Novák, 1890, *P. crassimargo* Römer.

Cyphaspis ceratophthalmus Goldf. and *C. hydrocephala* Römer.

Dechennella Verneuili Barr., *D. Burmeisteri* nov. for *Tril verticalis* Burmeister, 1843, pl. V, fig. 9a, not 9b. *Dechenalla Kayseri* nov., *D. Romanovski* Tschern, *D. Tschernyschewi* nov., *D. uralica* nov.

Harpes macrocephalus Goldf. refers *H. ungula* Burmeister, 1843, to this.

Lichas armata Goldf. var. *berolinensis* and *geesiana* nov. *Lichas beryllifera* nov., *L. parvula* Novàk, syn. *L. Haueri* Barr., pl. 28, fig. 38, non 39-40.

Acidaspis elliptica Burmeister refers *Arges armata* Goldf. 1839, pl. 33, fig. 1e and d, non a, b, c. *Odontopleura dentata* Goldf., 1843, and *Acidaspis armata* Römer, 1876, Atlas, pl. 31, fig. 7, to this species.

Acidaspis aries nov., *A. radiata* Goldf. refers *A. pilata Whidborne,* 1889, and *A. lacerata* Barr. to this species.

Cryphaeus rotundifrons Emm. the author refers C. laciniatus Roemer, and *C. acutifrons* Schlüter, to this species.

Cryphaeus Drevermanni nov. for *C. laciniatus* Drevermann, 1902. *Cryphaeus boopis* nov., *C. Kochi* Kayser, *C. Lethaeae* Kayser, for *Pleuracanthus laciniatus* Roemer, 1844, and that of Lethaea Pal. Atlas, pl. 25, fig. 10, 1876.

Cryphaeus diadema nov., *C. cometa* nov., *C. punctatus* Steininger, 1833, the *Calymmene archnoides* Höninghaus and other authors.

RICHTER (Rudolf)—Continued

Cryphaeus stellifer Burmeister, 1843.

Acaste Schmidti nov. *A. Henni* nov., *A. nolens* nov.

——— Das übergreifen der pelagischen Trilobitengattungen Tropidocoryphe and Thysanopeltis in das normale Rheinische Mitteldevon der Eifel und Belgiens.

Centralblatt für Mineral Geol. and Palæont. Jahrg., 1914, No. 3.

The author gives a figure in the text of *Tropidocoryphe Barroisi* Maillieux and refer to the genus *Tropidocoryphe ascania* (Corda), *T. memmon* (Corda), also *T. filicostata* Novák, the genotype.

The author figures *Thysanopeltis acanthopeltis* (Schnur.).

———Über das Hypostoma und einige Arten der Gattung Cyphaspis.

Centrabatt für Mineral Geol. Palæont. Jahrg., 1914, No. 10.

The author illustrates *Cyphaspis hydrocephala* Röm., *C. ceratophthalmus* Goldf., and two new species: *Cyphaspis ceratophthalmoides* and *stigmatophthalmus.*

——— Beiträge zur Kenntnis devonischer Trilobiten.

1 Die Gattung Dechenella und einige verwandte Formen. Abhandl d. Senckenb. Natuf. Gesellsch, Bd. 31, 1913, 9 text figures, 4 plates.

The author divides the Dechenella into one new genus and three subgenera:

(A.) Basidechenella nov. subg.

(B). Eudechenella nov. subg.

(C.) Paradechenella nov. subg.

(D.) Dechenella.

(E.) Schizoproetus nov. gen.

Under the subgenus Basidechenella the author places:

Dechenella (Basidechenella) Kayseri Rud. Richter.

D. (B.) dombrowiensis Gürich, *D. (B.) onyx* nov.

Dechenella sp. Beushausen and D. sp.

Under the subgenus Eudechenella.

Dechenella (Eudechenella) Verneuili Barrande, syn. *Archegonus aequalis* Steininger, 1853, and *Phillipsia verticalis* Kayser, 1878.

Dechenella (Eudechenella) aff. *Verneuili* sp. A-B-C.

Dechenella (Eudechenella) Burmeisteri Rud. Richter syn. *Phillipsia verticalis* Kayser, 1878; *Tril. verticalis* Schlüter, 1880.

Dechenella verticalis Oehlert, 1885, Kayser, 1880, and Asselbergs, 1912, under *Dechenella Verneuili* Kayser, 1880, Oehlert, 1885, Schmidt, 1905.

Dechenella (Eudechenella) granulata n. sp.

Dechenella (Eudechenella) rittergensis Zimmermann, 1892.

Dechenella (Eudechenella) setosa Whidborne, 1889.

Dechenella (Eudechenella) Romanovski Tschernyschew, 1887.

Dechenella (Eudechenella) Polonica Gürich, 1896.

C. Under the subgenus Paradechenella the author describes:

Dechenella (Paradechenella) Tschernyschewi Rud. Richter, 1909.

Dechella hofensis Leyh., 1897.

Dechenella waigatschensis Tschernyschew and Yakovlew, 1898.

Dechenella disjecta n. sp.

Dechenella dubia n. sp.

Phillipsia (Dechenella) cfr. *setosa* (Whidborne) *Gortani.*

Dechenella incerta Oehlert, 1889.

Proetidarum genus *uralicum* (Rud. Richter) the *Dechenella Haldemanni* Tschernyschew (non Hall), 1887.

RICHTER (Rudolf)—Continued

Under the new genus Schizoproetus the author places:

Schizoproetus celechovicensis (Smycka), 1895.

The work also includes notes on *Proetus unguloides* Barr. and *Phillipsia raclawicensis* Jarosz. The first referred by Gortani, 1907, to Dechenella, and the second by its author to that genus.

—— Beiträge zur Kenntnis devonischer Trilobiten.

Abhhandl der Senckenbergischen Nat. Ges. Bd. 31, 1913, pp. 346-423, plates 22 and 23.

The author describes and illustrates under (A.) Drevermannia n. genus, *D. Schmidti* n. sp., *D. brecciae* n. sp., *D. adorfensis* n. sp., *D. nodannulata* n. sp., *D.* n. sp., a, b, *D. globigenata* n. sp., *D. carnica* n. sp., *D. ? formosa* nov.

Under (B) Cyrtosymbole, new genus, the following species:

Cyrtosymbole Escoti Koenen, 1886; described under the genus Dechenella by Koenen Frech in 1887.

Cyrtosymbole n. sp., *C. nana* n. sp., *C. calymmene* n. sp., *C. bergica* n. sp., *C. wildungensis* n. sp., *C. Ussheri* Ivor Thomas *(Dechenella Ussheri* Thomas, 1909).

Cyrtosymbole dillensis (described by Drevermann, 1901, under Proetus), *C. pusilla* (described by Gürich, 1896, under Dechenella), *C. elegans* (described by Münster, 1842, under the genus Otarion), *C. Vinassai* (described by Gortani, 1907, under Dechenella), Cyrtosymbole sp., *C. italica Gortani.*

Under (C) Typhloproetus Frech nomen MSS.: *T. microdiscus* Frech mscr., 1909.

Under (D) Pteroparia n. gen., *P. columbella* n. sp.

Under (E) Proetus (Euproetus) nov. subgen. *Euproetus bivallatus* n. sp. and *E. glacensis* n. sp.

Under (F) Proetidae (subg.): *P. subcarintiacus* n. sp., *P. carintiacus* Drevermann, *P.* ex. aff. *carintiacus* Drevermann, *P. pusillus* Münster, (described under Asaphus Münster, 1840), *P. ebersdorfensis* n. sp., *P. Gortanii* n. sp., *P. palensis* n. sp., *P. Gümbeli* (The *Asaphus Cawdori* Münster, 1840), *P. anglicus* n. sp., *P. eurycraspedon* n. sp., *P. marginatus (Calymmene marginata* Münster, 1842).

Under (G) *Euproetus macrophthalmus (Cylindraspis macrophthalmus* Sandberger, 1850-56.):

Proetus (subg.) *furcatus (Calymmene furcata* Münster, 1842).

Proetus (Calymmene) furcatus Richter, 1856, non Münster.

Proetus Münsteri (Calymmene marginata Richter and Unger, 1856).

Proetus Münsteri (Calymmene marginata Münster, Richter, 1869).

Proetus (Otarion) elegans Richter, 1869: *P. tenellus* Richter, 1869, Proetus (subg.) n. sp. a-c.

Trilobites Münsteri Gümbel, 1879. *(Agnostus pisiformis* Münster, 1840).

Proetus sp. indet. Tietze, 1870; *Proetus* cfr. *Phocion* Billings Gortani, Proetus sp. indet. Gortani, Proetus f. ind. Rzehak. *Proetus ackensis* Born, 1912, *P.* sp. Born.

——— Neue Beobachtungen über den Bau der Trilobitengattung Harpes.

Geol. Anzeiger, Ba. 45, No. 4, 1914.

Harpes macrocephalus Goldfuss.

Ritter (R.) 1—Aus dem thüringischen Schiefergebirge.

Zeitsch. Deutsch. Geol. Ges., vol. 15, Heft 4, 1863, pp. 659-676, plates 18-19.

Harpes radians n. sp. *Proetus dormitans* n. sp., *P.* sp. *Phyllaspis raniceps* n. gen. et sp. *Arethusina* sp. *Phacops strabo* n. sp., *P. pyrifrons* n. sp., *P. Roemeri* Geinitz,

RITTER (R.)—Continued

P. liopygus n. sp. *Acidaspis myops* n. sp. *Beyrichia (Leperditia) armata* n. sp., *B. Klöedni* McCoy, *B. subcylindrica* nov.

Corrections for reference on page 184, Bibliography Palæozoic Crustacea.

——— Der Kulm in Thuringen.

Zeitsch. Deutsch. Geol. Ges., 1864, p. 155.

Proetus posthumus n. sp. *Cythere spinosa* n. sp.

— -- Untersilurische Petrefakten aus Thuringen.

Zeitsch. Deutsch. Geol. Ges., 1872, p. 72.

Calymmene sp. *Asaphus marginatus* n. sp. *Beyrichia excavata* n. sp.

Roberts (George L.) On some Crustacean Tracks from the Old Red Sandstone near Ludlow.

Quart. Jour. Geol. Soc., vol. 19, 1863, pp. 233-235.

— — and **Randall** (John). On the Upper Silurian Passage beds at Linley, Salop.

Quart. Jour. Geol. Soc., vol. 19, 1863, pp. 229-232.

Roemer (F.) Geoghostische Beobachtungen im polnischen Mettlelgebirge.

Zeitschr. d. Deutsch Geol. Ges., Bd. xviii, 1866.

Phacops cryptophthalmus Emm. Roemer's pl. xiii, figs. 6-7, has been described by Prof. Frech as *Phacops (Trimerocephalus) anophthalmus* n. sp. Lethaea Palæozoica, Bd. 2, pp. 124, 178, 179, 180.

— — *Eurypterus lacustris* von Buffalo, New York.

55 Jahrester der schles Ges., 1877.

Rogers (Austin F.) Some new American species of Cycles from the Coal Measures.

Contributions Geol. Dept. Columbia Univ., No. 88, vol. X, 1902.

Kansas Univ. Bull., vol. 1, 1902, pp. 269-275, plate 14.

Cyclus communis n. sp., *C. Packardi* n. sp., *C. permarginatus* n. sp., *C. limbatus* n. sp., *C. minutus* n. sp.

Rouault (Marie). Notice sur quelques especies de fossiles du Terrain Devonien du nord du Dept. de la Manche.

Bull. Soc. Geol. France, vol. 12, 1855, p. 1040.

Homalonotus Forbesi n. sp.

Add to the reference on p. 190, Bib. Pal. Crust., under Mem. Palæozoques des environs de Renness, 1851, the following species: *Cyphaspis Gaultieri* n. sp. *Phacops Michelini* n. sp. and *Beyrichia Hardouinina* n. sp.

Rowley (R. R.) Descriptions of Fossils.

Contributions to Indiana Palæontology, Green, New Albany, vol. 2, part 2, pp. 21-31, plate, 1906.

Gives systematic descriptions of various species of Trilobites and Crinoids.

——— The Geology of Pike County.

Missouri Bureau of Geol. and Mines, vol. 8, 2nd series, 1907, 122 pp., 20 plates and map.

ROWLEY (R. R.)—Continued

The author notes and illustrates the following Ordovician Trilobites:

Illaenus taurus Hall. *Asaphus gigas* DeKay, *A. megistos* Locke. *Lichas trentonensis* Conrad, Illaenus sp.

Carboniferous Crustaceans Phillipsia *Strantton Porteri* n. sp., *P. Missouriensis* Shumard.

Ruedemann (Rudolf). Trenton conglomerate of Rysedorph Hill, Rensselaer County, New York, and its fauna.

Bull. N. Y. Museum, No. 49, 1901, pp. 3-114, plates 1-7.

Tretaspis reticulatus n. sp., *T. diadema* n. sp.

These species are specially characterized by the presence of the glabellar pits, the apical tubercle on the glabella and the ocular tubercles, the eye lines, the deep dorsal furrow, and the structure and profile of the marginal border. *T. seticornis* His. is the typical form.

Ampyx (Lonchodomas) hastatus n. sp. *Remopleurides tumidus* n. sp., *R. (Caphyra) linguatus* n. sp. *Isotelus maximus* Locke. *Gerasaphes Ulrichana* Clarke. *Illaenus Americanus* Bill. *Thaleops ovata* Conrad. *Cyphaspis matutina* n. sp., *C. hudsonica* n sp. *Bronteus lunatus* Bill. *Cybele* sp. *Calymmene senaria* Conrad. *Ceraurus pleurexanthemus* Green. *Sphaerocoryphe major* n. sp. *Dalmanites achates* Bill. *Pterygometopus choraceus* Clarke, *P. callicephalus* Hall.

Ostracoda: *Leperditia fabulites* Conrad, *L. resplendens* n. sp. *Isochilina armata* Walc. var. *pygmaea* n. var. *Aparchites minutissimus* Hall var. *robustus* n. var. *Schmidtella crassimarginata* Ulrich var. *ventrilabiata* n. var. *Eurychillina reticulata* Ulrich, *E. bulbifera* n. sp., *E. ? solida* n. sp., *E. subradiata* Ulrich var. *rensselaerica* nov., *E. dianthus* nov., *E. ? anthus* n. sp., *E. obliqua* n. sp., *Primitia mundula* Miller var. *Jonesi* n. var. *Bollia cornucopiae* n. sp. *Macronotella Ulrichi* n. sp., *M. fragaria* n. sp. *Bythocrypris cylindrica* Hall. *Lepidocoleus Jamesi* H. & W.

—— — The Lower Siluric shales of the Mohawk Valley.

N. Y. State Museum Bull., 162, 1912.

The author illustrates *Eoharpes ottawaensis* Billings.

Proetus undulostriatus Hall.

This is the *Olenus undulostriatus* Hall describes in Pal. N. Y., 1847, p. 258, pl. 67, fig. 3 a-b. The author doubtfully refers *Proetus parviusculus* Hall, of the 13th Report N. Y. State Mus., 1860, p. 120, and the *Proetus parviusculus* Ruedemann, Bull. 42, 1901, p. 536, and *Cyphaspis hudsonica* Ruedemann, Bull. 49, 1901, p. 64, pl. 4, figs. 8 and 9, to this species.

Acidaspis crossota Locke. *Calymmene senaria* Conrad. *Isotelus gigas* DeKay.

Ostracoda: *Ulrichia bivertex* Ulrich. *Eurychilina subradiata* Ulrich. *Primitiella unicornis* Ulrich var. *Ceratopsis chambersi* Miller var. *Technophorus cancellatus* nov. *Pollicipes silurica* Ruedemann, a barnacle from Snake Hill beds of Green Island, New York.

—— Palæontologia Universalis, Fac. 1, Ser. IV. Dr. Jacob Green's original of description North American Trilobites.

Calymene callicephala, original specimen N. Y. State Museum, pl. 233.

Calymene platys, original specimen N. Y. State Museum, pl. 234.

Asaphus micrurus, original specimen N. Y. State Museum, pl. 235.

Ceraurus pleurexanthemus, original specimen N. Y. State Museum, pl. 236.

The author quotes Dr. Green's monograph Trilobites of North America, published Oct. 1, 1832, for original description of the species illustrated. This is an error. The Synopsis of the Trilobites of North America, issued in June, 1832, in The Monthly

RUEDEMANN (Rudolf)—Continued

American Journal of Geology and Natural Science, pp. 558-560, plate 14, was the original publication in which Dr. Green figures *Asaphus micrurus*, fig. 3, and *Ceraurus pleurexanthemus*, fig. 10.

Account of some new or little known species of fossils, mostly from Palaeozoic rocks of New York.

Bull. New York State Mus., No. 189, 1916.

The author describes the following Crustacea:

Agnostus Cushiagi nov.

It differs from *A. Newtonensis* Weller and its congeners in the broad, anteriorly well-rounded convex cranidium and obscure glabella.

Amphilichas conifrons nov.

This species differs from *A. Trentonensis* Hall, in the entirely different outline of the middle lobe of the glabella, which in the former is widest behind and in the new species broadens forward.

Ceratiocaris (Liminocaris) salina nov.

Spathiocaris Emersoni Clarke.

These specimens differ markedly from the strange valves figured with *S. Emersoni* on plate 34, fig. 13, Pal. N. Y., vol. 7, which latter possesses a much broadened flat posterior fold and a very shallow anterior notch. The author makes a new species of this form, referring it to *Pholadocaris Lutheri*.

Spathiocaris lata nov., *S. chargrinensis* nov., *S. Cushingi* nov., *S. Williamsi* nov. This is of larger size than the congenors and is readily distinguished by its broad form and coarse lines.

On p. 98 the author gives a discussion on the genera Spathiocaris and the Discinocarina and certain organic bodies called Cardiocaris, Pholadocars, etc., by Woodward and Clarke, considered as Crustaceans by other authors (Roemer, DeVerneuil, Kayser and Dames) as aptychi of Goniatites.

Lepidocoleidae. *Anatifopsis Wardelli* nov.

Pseudoniscus.

The eyes of this genus have for some time been an object of speculation. Nieszkowski, pl. 2, fig. 15, who first described a Pseudoniscus, figured a small incision along the edge of the fixed cheek as place for the eye; Eichwald Lethaea Ross, p. 1445, speaks there of large lunular eyes, and Woodward, Mong. of the Merostoma, p. 177, fig. 65, restored the cephalon completely with eyes.

The author describes. *Pseudoniscus Roosevelti* Clarke and *P. Clarkei* nov., a Bertie Waterline species.

Echinognathus Clevelandi Walcott. *Eusarcus trigonus* nov.

Article II. Notes of the habitat of the Eurypterids.

Article IV. A new Ceraurus from the Chazy, by Percy E. Raymond. *Ceraurus Reudemanni* nov.

Article V. The presence of a median eye in Trilobites.

Gives figures in text of *Isotelus gigas* and *Basilicus tryannus*. It is claimed in this paper that most, if not all, Trilobites possessed a median or parietal eye on the glabella. A great number of species, belonging to more than 30 genera, possess a distinct tubercle on the glabella. This tubercle occurs alone in many genera otherwise smooth, as in Asaphidae and is hence of functional importance. The author gives a list of the species with median eye tubercles.

Article VI. The cephalic suture lines of Cryptolithus.

The author gives figures in the text of *Dionide formosa* Barr., *D. atra* Salter and *Cryptolithus tesselatus* Green. The author concludes that these genera are not Hypo-

RUEDEMANN (Rudolf)—Continued

peria, but belong among the families of Opisthoparia. The figure of *Cryptolithus tesselatus* shows the lateral facial suture and the lateral eye tubercle, also median eye tubercle.

Plate 36 contains a few figures of various genera of Trilobites with median eye tubercle, such as:

Isoteloides homalonotoides Walc. *Symphysurus convexus* Cleland. *Basilicus Kegelensis* Sch. *Symphysurus angustatus* S. & B. *Asaphellus monticola* Raym. *Asaphus ludibundus* mut. *jewensis* Schm. *Hemigyraspis collicana* Raym. *Nileus Armadillo* Dalm. *Ceratopyge forficula* Sars. *Niobe insignis* Linrs. *Barrandia crassa* Barr. *Æglina umbonata Illaenus oriens* M. & S. *Bronteus Haidingeri* Barr.

and **Clarke** (John M.) Catalogue of the type specimens of Palæozoic Fossils in New York State Museum.

Bull. New York State Museum, No. 65, 1903.

Crustacea, pp. 658-765 and 814.

Classification of the type specimens by geologic formations, pp. 815-847.

Sarle (Clifton J.) A new Eurypterid fauna from the base of the Salina of Western New York.

Bull. New York State Mus., No. 69, 1903, pp. 1087-1108, pls. 6-26.

The author proposed a new genus Hughmilleria for a small form, which from its general appearance in many ways suggests the genus Eurypterus, but a study of its structure shows it to be closely related to Pterygotus.

The author described *Hughmilleria socialis* nov. and var. *robusta* nov. var. A new species of Eurypterus is included under the name of *E. pittsfordensis*, which closely resembles *E. lacustris*, approximately of the same size, also in the position and shape of the eyes. The posterior portion of the cephalon flares out in *E. pittsfordensis*, or at least broadens out in a hyperbolic curve, while *E. lacustris* is marked by the nearly parallel sides of the cephalon.

The author also describes *Pterygotus monroensis* nov.

Savage (T. E.) Stratigraphy and Palæontology of the Alexanderian series in Missouri and Illinois, part one.

Bull. No. 23, State Geol. Sur. Illinois, 1913, 124 pp., with 7 plates.

The author describes *Proetus princeps* n. sp. This rare specimen from the Thebes, Illinois, has a glabella resembling that of *P. determinatus* Foerste, and differs but slightly from the Edgewood species. From the Girardeau limestone, Shumard, Geol. Mo., 1855, p. 198, gives the name of *Proetus depressus* to a species without figure or description. This is not the *P. depressus* Weller, Pal. N. J., vol. 3, p. 249.

The author also describes *Cyphaspis girardeauensis* Shumard. *Acidaspis Halli* Shumard. *Encrinurus deltoideus* Shumard and *Calymmene dubia* n. sp., which resembles *Calymmene platycephala* Foerste.

From the Edgewood series of Illinois the author describes:

Proetus determinatus Foerste, described as Bathyurus Foerste in the Bull. Lab. Den. Univ. vol. 1, p. 103, pl. 14, fig. 5, 1885.

Cyphaspis intermedia Weller, and *Metapolichas breviceps* var. *clintonensis* Foerste.

Dalmanites Danai Meek and Worthen.

The species resembles *D. limulurus* Green, but somewhat larger.

From Channahon, Illinois, the author describes *Proetus channahonensis* Weller. It has a more prominent glabella and deeper glabella furrows than *P. determinatus* Foerste.

SAVAGE (T. E.)—Continued

Cyphaspis intermedia Weller, *Metapolichas ferrisi* Weller, and a new species of Ostracoda, *Leperditia illinoisensis*—shell differing from *Leperditia faba*, in being shorter and more nearly circular in outline.

—— Some interesting new species of Arthropods from the Devonian strata of Illinois.

Am. Jour. of Science, vol. 35, 1913, p. 149-152, figures.

The author describes *Lepidocoleus Illinoisensis* n. sp. a barnacle from the Clear Creek of Union County Oriskany chert and a new trilobite *Dalmanites palaceus*. This shovel form closely resembles *D. tridentiferus* Shumard, but the anterior extension is short and concave with margin entire instead of having that extension prolonged into a three-lobed process.

— Alexandrian Rocks of Northeastern Illinois and Eastern Wisconsin.

Bull. Geol. Soc. Am., vol. 27, 1916, pp. 305-344, pls. 15-17.

Eurypterus pumilus nov.

Schlüter (Clemens). Neuere Arbeiten über die ältesten Devon Ablgerungen des Hartz.

Verdhandl, des Naturhist, Verenins der preuss. Rheinl. und Westfalens, vol. 35, Jahrg. 4, Folge V, Bd. p. 330.

Gives a list of Fossil Crustacae.

Schmidt (Friedrich). Physikalische Section.

Sitzungsb. d. niederrhein Gesellschaft, in Bonn, 1881.

The author describes *Cryphaeus limbatus*, p. 77, and *C. acutifrons* nov., p. 144, and *C. rotundifrons* Emm.

Richter refers the last two species to *Cryphaeus rotundifrons* from the Eurypterus beds of Oesel, and compared them with those of North America.

——— Ueber die neue Merostomenform *Stylonurus Simonsoni* aus dem Obersilur von Rootzküll auf Oesel.

Bull. Acad. Imp. Sci. de St. Petersb. ser. 5, vol. 20, No. 3, p. 199.

—— — Revision der Ostbaltischen Silurischen Trilobiten. Abtheilung V, Asaphiden Lieferung 1.

Mem. Acad. St. Petersburg, 8th ser., vol. 6, No. 11, 1898.

Gen. Asaphus Brong. emend. Ang.

Asaphus expansus Dalm. and var. *lepidura* Nieszk., *A. raniceps* Dalm., *A. Broggeri* n. sp., *A. pachyophthalmus* n. sp., *A. platyurus* Ang., *A. Kowalewskii* Lawr., *A. Eichwaldi* n. sp., *A. cornutus* Pander, *A. laevissimus* n. sp., *A. latus* Pander, *A. delphinus* Lawr., *A. ornatus* Pomp., *A. devexus* Eichw., *A. Nieszkowskii* n. sp. Mut. *Itferensis* Mut. *Jewensis* Mut. *Kegelensis*, *Asaphus Stacyi* n. sp.

Subgen. Onchometopus Schmidt.

Onchometopus Volhorthi n. sp.

Subgen. Ptychopyge Angelin.

Ptychopyge angustifrons Dalm., *P. excavato-zonata* Ang. and var. *truncata* Nieszk., *P. limbata* Ang. ? *P. Lawrowi* n. sp., *P. Kuckersiana* n. sp., *P. globifrons* Eichw., *P. tectieaudata* Steinh.

Gen. Isotelus Dekay.

Isotelus remigium Eichw., *I. platyrhachis* Steinh., *I. robustus* Rom.

SCHMIDT (Friedrich)—Continued

Gen. Niobe Angelin.

Niobe laeviceps Dalm., *N. frontalis* Dalm.

Megalaspis planilimbata Ang., *M. limbata* Boeck, *M. polyphemus* Brogg., *M. Kolenkoi* n. sp., *M. Mickwitzi* n. sp., *M. hyorhina* Herz. v. Leucht., *M. gibba* n. sp., *M. Lawrowi* n. sp., *M. longicauda* Herz. v., Leucht. (mit *M. gigas* Ang.), *Meglaspis extenuata* Wahlb., *M. acticauda* Ang., *M. heros* Dalm.

Gen. Nileus Dalman.

Nileus Armadillo Dalm.

— —— Revision der Obstbaltischen Silurischen Trilobiten. Abtheilung V. Asaphiden Lieferung II.

Mem. Acad. St. Petersburg, 8th ser., vol. 12, No. 8, 1901, 12 plates.

Asaphus Broggeri n. sp., *A. expansus* Dalm., *A. lepidurus* Nieszk., *A. raniceps* Dalm. var. *Lamanskii* and var. *acuminata* Boeck.

Asaphus pachyopthalmus n. sp. var. *minor* and var. *major*, *A. Eichwaldi* n. sp. var. *Knyrkoi*, *A. delphinus* Lawr., *A. cornutus* Pand. and var. *Holmi*, *A. Kowalewskii* Lawr., *A. platyurus* Ang., *A. laevissimus* n. sp. and var. *laticauda*, *A. latus* Pand. and var. *Plautini*, *A. devexus* Eichw., *A. ornatus* Pomp., *A. ludibundus* Torq. mut. *Itferensis* mut. *jewensis* mut. *Kegelensis*.

Onchometopus Volborthi n. sp.

Gen. Isotelus Dekay.

Isotelus remigium Eichw., *I. platyrhachis* Steinh., *I. robustus* F. Rom., *I. Stacyi* n. sp.

Gen. Niobe Angelin.

Niobe laeviceps Dalm., *N. Lindstromi* n. sp., *N. frontalis* Dalm.

——— Communication before the Section of Geology and Mineralogy, Oct. 19, 1902, announcing the discovery of *Eurypterus simonsoni*.

Comptes rendus des Sci. in Travaux de la Soc. Imp. de Nat. de St. Petersburg, vol. 33, livr. 1, No. 6, 1902, pp 202-3, in Russian.

——— Ueber die neue Merostomenform *Stylonorus simonsoni* aus dem Odersilur von Rootzküll auf Oese.

Bull. Acad. Imp. de Sci. St. Petersburg, vol. 20, No. 3, ser. V, 1904, pp. 99-105, plate.

——— Revision der Ostbaltischen Silurischen Trilobiten. Abtheilung V, Asaphiden Lieferung III.

Mem. Acad. St. Petersburg, 8th. ser., vol. 14, No. 10, 1904, 8 plates.

Gen. Ptychopyge Angelin.

Subgen. Pseudasaphus.

Pseudasaphus globifrons Eichw., *P. ? Mickwitzi* n. sp., *P. tecticaudatus* Steinh. and var. *praecurrens*.

Subgen. Basilicus Salter.

Basilicus Lawrowi n. sp., *B. kuckersianus* n. sp., *B. keyelensis n.* sp.

Subgen. Ptychopyge sens. str.

Ptychopyge angustifrons Dalm. and var. *gladiifera*, *P. truncata* Nieszk. and var. *Broggeri*, *P. cincta* Brogg., *P. Plautini* n. sp., *P. Wohrmanni* n. sp., *P. Knyrkoi* n. sp., *P. Pahleni* nov.

Gen. Ogygia Brongniart auct.

Ogygia dilatata Brunn var. *Panderi* n. var. and var. *Plautini*.

Gen. Nileus Dalman.

Nileus Armadillo Dalm.

SCHMIDT (Friedrich)—Continued

—— - - Revision der Ostbaltischen Silurischen Trilobiten. Abtheilung V, Asaphiden Lieferung IV.

Mem. Acad. St. Petersburg, 8th ser., vol. 19, No. 10, 1906, 8 plates.

Megalaspis planilimbata Ang. and var. *Leuchtenbergi* Lam., *M. limbata* Boeck and var. *elongata*, *M. Lawae* n. sp., *M. polyphemus* Brögg. aff. and var. *Tornquisti* var. *minor* var. *Lamanskii* and var. *Knyrkoi*, *M. hyorhina* Leucht. also var. *Kolenkoi*, *Mickwitzi* and *Stacyi*.

Megalaspis Pogrebowi Lam., *M. Knyrkoi* n. sp., *M. gibba* n. sp., *M. acuticauda* n. sp. also var. *typica*, *obtusa*, *triangularis* and *Lamanskii*.

Megalaspis extenuata Dalm., *M. heros* Dalm., *M. centaurus* Dalm. and var. *rudis*, *M. Lawrowi* n. sp.

——— Revision der Ostbaltischen Silurischen Trilobiten.

Memoiries Acad. Imp. des Science de St. Petersburg, vol. xx, No. 8, 1907.

Phacops elliptifrons Esm., *P. Downingiae.* Murch. *Pterygometopus.*

Phacops sclerops Dalm., *P. trigonocephala* F. S., *P. Panderi* F. S., *P. exilis* Eichw., *P. laevigata* F. S., *P. Kuckersina* F. S., *Kegelensis* F. S., *P. Nieszkowskii* F. S.

Subgenus Chasmops. *Phacops ingrica* F. S., *P. nasuta* F. S., *P. praecurrens* F. S., *P. Odeni* Eichw., *P. Odini* var. *itferensis* F. S., *P. marginata* F. S., *P. bucculenta* Sjogr., *P. Wrangeli* F. S., *P. brevispina* F. S., *P. mutica* F. S., *P. Wenjukowi* F. S., *P. maxima* F. S., *P. Wesenbergensis* F. S., *P. Eichwaldi* F. S.

Cheirurus ornatus Dalm., *C. ingricus* F. S., *C. exsul* Beyr., *C. macrophthalmus* Kut., *C. gladiator* Eichw., *C. spinulosus* Nieszk., *C.* cf. *glaber* Ang.

Subgenus Crytometopus. *Cheirurus primigenus* var. *Lamanskii* Ang., *C. clavifrons* Dalm., *C. affins* Ang., *C. Plautini* F. S., *C. aries* Eichw., *C. Pseudohemicranium.*

Subgenus *Sphaerexocoryphe cranium* Kut., *S. Hubneri* F. S., *S.* cf. *granulata* Ang.

Subgenus *Pseudosphaerexochus hemicranium* Kut., *P. conformis* Ang., *P. Pahnschi* F. S., *P. Roemeri* F. S.

Subgenus *Nieszkowskia tumida* Ang., *N. variolaris* Linrs., *N. cephaloceros* Nieszk.

Sphaerexochus angustifrons Ang. *Deiphon Forbesi* Barr.

Amphion Fischeri Eichw., *Diaphanometopus Volborthi* F. S.

Crotalurus Barrandei Volb.

Cybele bellatula Dalm., also var. *Wohrmanni* F. S., *C. Panderi* F. S., *C. Revaliensis* F. S., *C. rex* Nieszk., *C. Grewingkii* F. S., *C. coronata* F. S., *C. Worthi* Eichw., *C. affinis* F. S., *C. Kutorgae* F. S., *C. brevicauda* Ang.

Encrinurus obtusus cf. Ang., *E. punctatus* Wahlb., *E. multisegmatatus* Portl., *E. Sechachi* F. S.

Acidaspis Marklini Ang., *A. Kuckersiana* F. S. and var. *Mickwitzi* F. S. *Lichidae* subgen. Arges *Lichas wesenbergensis* F. S.

Subgen. Leiolichas. *Lichas illaenoides* Neiszk.

Subgen. Platymetopus. *Lichas lineatus* Ang., *L. dalecarlicus* Ang., *L. Holmi* F. S.

Subgen. Metopias. *Lichas celorhin* Ang., *L. verrucosus* Eichw., *L. pachyrhinus* Dalm., *L.* var. *longerostrata* F. S., *L. platyrhinus* F. S., *L. Hübneri* Eichw., *L. Kuckersianus* F. S.

Subgen. Hoplolichas. *Lichas tricuspidatus* Beyr. and var. *longispina* *L. Plautini* F. S., *L. furcifer* F. S., *L. conicotuberculatus* Nieszk.

Subgen. Conolochas. *Lichas triconicus* Dam., *L. aequilobus* Steinh., *L. schmidtii* Dam.

Subgen. Ceratolichas. *Lichas inexpectatus* F. S.

Subgen. Homolichas. *Lichas depressus* Ang., *L. Pahleni* F. S., *L. deflexus* Sjogr., *L. Eichwaldi* Nieszk., *L. angustus* Beyr.

SCHMIDT (Friedrich)—Continued

Subgen. Oncholichas. *Lichas ornatus* Ang., *L. gotlandicus* Ang.

Subgen. Platylichas. *Lichas St. Mathiae, L. margaritifer* Nieszk., *L. docens* F. S., *L. cicatricosus* Lov., *L. hamatus* F. S., *L. laxatus* McCoy.

Illanus Esmarcki Schl., *I. sphaericus* Holm., *I. jewensis* Holm., *I. laticlavius* Eichw., *I. chiron* Holm., *I. intermedius* Holm., *I. crassicauda* Waldh., *I. tauricornis* Kut., *I. ariensis* Holm., *I. sulcifrons* Holm., *I. Plautini* Holm., *I. revaliensis* Holm., *I. Dalmani* Volb., *I. oculosus* Holm., *I. chudleighensis* Holm., *I. sinuatus* Holm., *I. Schmidtii* Nieszk., *I. ladogensis* Holm., *I. oblongatus* Ang., *I. Roemeri* Volb., *I. angustifrons* Holm., *I. atavus* Eichw., *I. Maseckei* Holm., *I. centrotus* Dalm., *I. Linnarssoni* Holm., *I. proles* Holm., *I. livonicus* Holm., *I. triquetrus* Volb., *I. caecus* Holm.

Subgen. Bumastus. *Illaenus barriensis* Murch., *I. sulcatus* Lindstr.

Calymmendiae: *Calymmene tuberculata* Brunn., *C. intermedia* Linstr., *C. frontosa* Lindstr., *C. laevigata* F. S., *C. conspicua* F. S., *C. spectabilus* Ang., *C. Stacyi* F. S.

Subgen. Pharostoma. *Calymmene pedibola* F. Rom., *C. Nieszkowskii* F. S., *C. denticulata* Eichw.

Subgen. Ptychometopus. *Calymmene Volborthi* F. S.

Bronteidae: *Bronteus laticauda* Wahl., *B. estonicus* F. S., *B. Marklini* Ang.

Proetidae: *Proetus concinnus* var. *Osiliensis* F. S., *P. verrucosus* Lindstr., *P. conspersus* Ang., *P. planedorsatus* F. S., *P.* cf. *distans* Lindstr., *P. ramisulcatus* Nieszk., *P. Kertelensis* F. S., *P. Wesenbergensis* F. S., *P. Wöhrmanni* F. S.

Cyphaspis elegantula Lov., *C. planifrons* Eichw.

Menocephalus minutus Nieszk.

Harpedidae: *Harpides Plautini* F. S.

Harpes Spasskii Eichw., *H. Wegelini* Ang.

Trinucleus seticornis His.

Ampyx Volborthi F. S., *A. Linnarssoni* F. S., *A. costatus* Sars ? *A. rostrata* Sars, *A. Kuyrkoi* F. S., *A. dubius* F. S.

Remopleurides nanus Leucht., *R.* var. *elongata* F. S., *R. emarginatus* Törnq.

Dikellocephalidae: *Apatocephalus serratus* Sars and Boeck; also var. *dubius* Mob.

Agnostus glabratus var. *ingrica* F. S.

Asaphus Broggeri F. S., *A. expansus* Dalm., *A. lepidurus* Nieszk., *A. raniceps* Dalm., *A. pachyophthalmus* F. S., *A. Eichwaldi* F. S., *A. delphinus* Lawr., *A. cornutus* Pander, *A.* var. *Holmi* F. S., *A. Kowalewskii* Lawr., *A. platyurus* Ang., *A. laevissimus* F. S.; also var. *laticauda* F. S., *A. latus* Pander and var. *Plautini* F. S., *A. devexus* Eichw., *A. ornatus* Pomp., *A. lepidus* Törnq. *Nieszkowskii* F. S. and var. *jewensis* F. S., *A. Kegelensis* F. S.

Onchometpus Volborthi F. S.

Isotelus remigium Eichw., *I. platyrhachis* Stein, *I. robustus* F. Rom., *I. Stacyi* F. S.

Niobe laeviceps Dalm., *N. Lindstromi* F. S., *frontalis* Dalm., *N. Volborthi* F. S.

Ptychopyge Ang. subgen. Pseudasaphus F. S., *P. globifrons* Eichw., *P. tecticaudatus* Steinh.

Subgen. Basilius Salt., *B. Lawrowi* F. S., *B. Kuckersianus* F. S., *B. Kegelensis* F. S.

Ptychopyge angustifrons Dalm., *P.* var. *gladiifera* F. S., *P. truncata* Nieszk. and var. *Broggeri, P. cincta* Brogg., *P. Plautini* F. S., *P. limbata* Ang., *P. Knyrkoi* F. S., *P. Pahleni* F. S.

Ogygia dilatata var. *Panderi* F. S., *P. dilatata* var. *Plautini* F. S.

Nileus Armadillo Dalm.

Megalaspis planilimbata Ang., *M. limbata* Boeck, *M. Lawae* F. S., *M. polyphemus* Br. aff. and var. *minor* F. S., *M. Lamanskii* F. S., *M. Knyrkoi* F. S., *M. hyorhinus* Leucht and var. *Kolenkoi* F. S., *M. Mickwitzii* F. S., *M. Stacyi* F. S., *M. Pogrebowi* F. S., *M. Knyrkoi* F. S., *M. gibba* F. S., *M. acuticauda* Ang., *M. extenuata* Dalm., *M. heros* Dalm., *M. centaurus* Dalm. and var. *rudis* Ang., *M. Lawrowi* F. S.

SCHMIDT (Friedrich)—Continued

Megalaspides Schmidtii Lam.
Olenellus Mickwitzi F. S.
Cheirurus (Cyrtometopus) primigenus Ang., *Cybele bellatula* var. *Wohrmanni.*
Lichas Pahleni F. S., *L. cicatricosus* Loven, *Niobe Volborthi* F. S.
Cyrtometopus Pseudohemicranium Nieszk. *Encrinurus Seebachi* F. S.
Calymmene frontosa Lindstr., *C. laevigata* and *conspicua* F. S.
Asaphus lepidus Törnq. and *A. Nieszkowski* F. S. *Niobe laeviceps* Dalm.
Megalaspis hyorLina Leucht.

Schmidt (W. E.) Cryphaeus in dem Siegener Schichten.

Zeitschr. d. Deutsch. Geol. Ges., vol. 59, 1907.

The author describes as *Cryphaeus attavus* a species with a head and a short, triangular pygidium, which shows a faint development of four pairs of marginal lappets, seen best by the four pairs of pits within the doublure.

Dr. Clarke in his paper on Devonic of Parana, p. 156, remarks: This, certainly, is not a Cryphaeus, even phylogenetically, for exceedingly young forms of Cryphaeus have sufficiently demonstrated that the ontogeny presents no four-spined stage. The tail is similar in the character of its lappets to those obscure structures in *Proboloides pessulus,* a new genus created by Clarke in the same work.

Schumacher (R.) Ueber Trilobitenreste aus dem Unterkarbon im Ostlichen Teil des Rosbergmassivs in den Südvogesen.

Zeitschr. Deutsch. Geol., Ges. 55, 1903, pp. 432-438, plate 19.
Phillipsia Silesiaca Scupin, *P. Eichwaldi* var. *alsatica* n. var.
Griffithides Frechi Scupin, *G. Damesi* Scupin.

Schuchert (C.) On the Lower Silurian (Trenton) fauna of Baffin Land.

Proc. Natl. Museum, vol. 22, 1900, pp. 143-177, plates 12-14.
Dalmanites (Pterygometopus) Goodridgi n. sp. *Illaenus vigilans* H. & W., *I. crassicauda Americanus* Billings. *Isotelus gigas* DeKay. *Ceraurus pleurexanthus* Green.

Scupin (Hans). Die Trilobiten des niederschlesischen Untercarbon.

Zeitschr. Deutsch. Geol. Ges., Jahrg, 1900, pp. 1-20, plate, figs. 1-3, text.
Phillipsia aff. *aequalis* Meyer, *P. longicornis* Kays., *P. gemmulifera* Phill., *P. truncatula* Phill., *P. Silesica* n. sp., P. Spec.
Griffithides Damesi n. sp., *G. Frechi* n. sp., *G. depressus* n. sp., *G. claviger* n. sp.

Seemann (Fr.) Beiträge zur Gigantostraken fauna Böhmens.

Beitr. zur. Pal. and Geol. Österr-Ung. u. d. Orients, Bd. 19, Hft. 1, p. 49, 1906.

Semper (M.) Die Gigantostraken des älteren böhmischen Paläozoicum.

Beiträge zur Palæontologie and Geol. Oesterreich-Ungarns u. d. Orients, Bd. 11, 1898, p. 71.

Seward (A. C.) Notes on Fossil Plants from the Witteberg series of the Cape Colony.

Geol. Mag., Decade 5, vol. 6, No. 11, 1909, p. 482.

The author refers the *Hastimima Wheitei* to the genus Eurypterus, p. 485, as part of a body segment of that genus.

This paper is followed on p. 486 with a note on the genus Hastimima from Brazil and the Cape, by Henry Woodward, in which the author compares it with *Eurypterus punctatus* Salter.

Shimer (H. W.) Almost complete specimen of *Strenuella strenua* Billings.

Am. Jour. Science, vol. 23, 1907, pp. 199-201, figure.

In the Amer. Jour. Sci., vol. 23, 1907, p. 319, the author refers *Ptychoparia murronatus* Shaler and Foerste, Bull. Mus. Zool., vol. 16, plate 2, to *Strenuella strenua* Billings, remarking that it appears that *S. strenua* is quite variable in the shape of the free cheeks and in the ornamentation of the axis.

Shuler (E. W.) New Ordivician Eurypterid.

Am. Jour. Sci., vol. 39, 1915, p. 551.

Stylonurus (Ctenopterus) alveolatus p. 552, fig. in text 1-6, from the Bay sandstone, Walker's Mt., Virginia.

The subgeneric name of Ctenopterus was used on account of the long, flattened segments of the endognathite; the lack of serrations on the segments, such as is found in Eurypterus; the presence of the long joint, belonging probably to the walking leg or balancer characteristics of Stylonurus, and the long, broadened spines or bristles which are especially characteristic of the subgenus Ctenopterus.

Siegert (L.) Versteinerungs-führenden Sedimentgeschiebe im Glacialdiluvium des Nordwestlichen Sachsens.

Palæontologisches Institut der Univ. Leipzig, 1898, pp. 37-138.

Cambrian: *Eurycare latum* Ang. *Peltura scarabaeoides* Wahl. *Sphaerophthalmus alatus* Boeck.

Silurian: *Asaphus expansus* Dalm. *Cheirurus (Nieszkowskia) variolaris* Lin. *Remopleurides nanus* c. Leucht. *Agnostus glabratus* Ang. *Chasmops conicophthalmus* S. & B. *Beyrichia costata* Lin. *Chasmops macrourus* Sjogren, *C. Wesenbergensis* Schmidt.

***Siemiradski** (J. von). Die Paläozischen Gebilde Podoliens. (Not seen.)

11 Paläontologischer Teil Wien Beitr. Pal. Geol., Ost Ung. 19, 1906, pp. 213-286, Taf. xv-xxi.

Siemiradzki (von Jos.) Die palæozoischen Gebilde Podolens.

Beiträge Z. Pal. and Geol. österr-Ung. u. s. Orients, Bd. 19, Heft 2, vol. 3, 1906, p. 4.

Six (Achille). Les appendices des Trilobites d'aprés M. Ch. D. Walcott.

Soc. Geol. du Nord, Ann. xi, 1883-84, pp. 228-236.

Slocum (A. W.) On the Trilobites of the Maquoketa beds of Fayette County, Iowa.

Field Mus. Nat. Hist., No. 171, Geol. Ser., vol. 4, No. 3, pp. 43-83, plates 13-18, 1913.

The author has secured from these beds 20 species of Richmondian Trilobites, 17 of which are here named, 11 of them being new.

The new genus Cybeloides is also defined.

The author describes and illustrates the following Crustacae:

Isotelus gigas DeKay, *I. maximus* Locke, with the remark that most of the specimens of Isotelus from this locality, which have been referred by other authors to *I. maximus*, are here referred to *Isotelus Iowenis* Owen.

Isotelus Iowensis Owen. *Megalaspis Beckeri* sp. nov. Compares *M. gonioceras* Meek and *M. extenuata* Angelin.

Nileus vigilans Meek and Worthen. *Bumastus Beckeri* sp. nov. *Thaleops ovata* Conrad. *Amphilichas rhinoceros* sp. nov., *A. clermontensis* sp. nov.

SLOCUM (A. W.)—Continued

Encrinurus pernodosus sp. nov.

Cybeloides gen. nov. This genus differs from Cybele Loven, as exhibited in *C. bellatula* the genotype, in the form of the glabella furrows, and in the genal angles being produced into spines, instead of being rounded.

The author describes *Cybeloides iowensis* sp. nov.

Calymmene fayttensis sp. nov., *C. gracilis* sp. nov. *Ceraurus pleurexanthemus* Green, *C. Milleranus* Miller and Gurley, *C. elginensis* sp. nov.

Eccoptochile meekanus S. A. Miller.

Sphaerocoryphe maquokensis sp. nov. *Pterygometopus Fredricki* sp. nov., *P. larrabeei* sp. nov.

Smith (J. F., Jr.) Canadian Journal, new series, vol. 6, 1861, p. 275.

Triarthrus canadensis nov.

The genal angles of the head are spined.

Smycka (F.) Beiträge zur Kenntniss der Trilobiten fauna in mahrischen Devon bei Celechovitz.

Acad. des Sci. de l'Empereur Francis Joseph, 1 Bull., Intern. class des Sci. Math. and Nat., pp. 19, plate 1, 1895.

The author gives a list of 60 species, which serves to indicate the Upper Devonian age of the fauna. He gives descriptions of several Trilobites, two of which are new, namely: *Proetus celechovincensis* n. sp. and *P. moravicus* sp. nov.

— - - Ueber die Trilobiten des Celechovitzer Devon in Mahren.

Vesmir Prag., 1895, Jahrg. 24, p. 136.

Bronteus intermedius Goldf. *Dechenella Verneuili* Barr.

This species is referred by Richter to *Dechenella (Eudechenella) ritthergensis* Zimmermann.

Proetus Celechovicensis n. sp., *P. maravicus* n. sp. and *Cyphaspis* sp.

Sobolev (D.) Mittel Devon des Kielce-Sandomir Gebirges.

Mater Geol. Ross., St. Petersburg, vol. 24, 1909, pp. 41-536, with 5 plates.

Devonian Ostracoda.

Spencer (W. K.) The hypostomaic eyes of Trilobites.

Geol. Mag., Decade 4, vol. 10, 1903, pp. 489-492, with 3 figures.

This is a review of Dr. Lindstrom's paper, "Researches on the Visual Organs of the Trilobites," to show the close correspondence of the maculae with certain sense organs present in the Phyllopod genus Branchipus, and also in Limulus.

Spriestersbach and Fuchs. Die Fauna der Remscheider Schichten.

Abh. Geol. Landesant, N. F. Heft 58, 1909, pp. 111 and 81, with 11 plates.

Beyrichia embryoniformis n. sp., *B. montana* n. sp. *Entomis* sp. *Cryphaeus* sp. (Dr. Green's genus Cryphaeus, 1837.) This generic name was used in 1833 for a genus of Coleoptera, therefore will have to be abandoned.

Stauffer (Clinton R.) The Middle Devonian of Ohio.

Geol. Sur. Ohio, Fourth Series, Bull. No. 10, 1909.

The author describes as new *Proetus Welleri* from Venice, Ohio. The species was referred by Rud. Richter to *Dechenella* (aff. ? *Eudechenella Welleri).*

Stepanov (P.) Fauna aus der Umgebung des Balchas Sees.

Verh. Russ. Mineral. Ges., Ser. 2, vol. 46, 1908, pp. 161-198, plates 1 and 2.

Leperditia shearsbii Chapman.

Steusloff (A.) Ostrakoden aus Diluvialgeschieben von Neu-Brandenburg.

Zeitschr. Deutsch. Geo. Ges., Jahrg., 1894, pp. 775-787, pl. 53.

Cambrian: *Bythocypris polita* n. sp.

Ordovician: *Primitia excelsa* n. sp., *P. reticulata* n. sp., *P. concinna* n. sp., *Beyrichia antiqua* n. sp., *B. digitata* var. *separata* n. var. *Entomis latisulcata* n. sp., *E. impressa* n. sp., *E. umbonata* n. sp.

Brandschiefer: *Strepula elliptica* n. sp. *Entomis sigma* Kr

Macroura Kalk: *Beyrichia Krausei* n. sp., *B. rostrata* Kr. *Entomis oblonga* n. sp.

Untersilurischer Beyrichien Kalk: *Primitia angulata* n. sp., *P. curva* n. sp. *Strepula lineata* var. *granulosa* n. var. *S. constans* n. sp.

Borkholmer Kalk: *Leperditia praelonga* n. sp. *Primitia cuneata* n. sp., *P. canaliculata* n. sp., *P. elongata* var. *obliqua* n. var., *P. rugosa* n. sp.

Leperditia Kalk: *Leperditia Krausei* n. sp., *L. ? Kiesowii* n. sp. *Isochilina frequens* n. sp. *(Leperditia brachynotus* F. Schm.) *? P. elongata* var. *semicircularis* n. var.

Fraglichen Alters: *Strepula signata* n. sp., *S. lineata* var. *separata* 111 Obersilur.

Obersilurischen Beyrichien Kalkes: *Primitia praerupta* n. sp., *P. punctata* n. sp. *Octonaria Bollii* n. sp.

Steusloff (A.) Sedimentärgeschiebe von Neubrandenburg.

Zietschr. d. Deutsch. Geo. Ges., vol. 44, 1892.

Stschegloff (H.) Sur les Trilobites en genéral et en particulier sur ceux de Zarskœ-Selo.

Jour. fur neue Entdeckungen in der Phys. Chem. Natur. und Technologie, St. Petersburg, Nos. 1, 2, 1827, p. 227, plate vii, fig. 9.

The author proposed the new genus *Deucalion* for such species as *Nileus armadillo, Illaenus crassicauda.*

Stur (D.) Der Trilobiten Fund des Herrn Kasch in den Kalkmuggeln des Heiligenberger Schachtes bei Pribran.

Verhandl. der K. K. Geol. Reich. Jhg., 1876, pp. 31-32.

Phacops fecundus Barr. also var. *major.*

***Swinerton.** On the classification of Trilobites. (Not seen.)

Geol. Mag., Decade vi, vol. —, 1915, p. 487.

The author states in regard to Beecher's Classification of 1897, that the majority of new Trilobites found since the publication fit into it without difficulty and prove that to a large extent it is conceived on a sound basis. A few, however, do not fit in, and have therefore revealed its weakness.

Taylor (Julius S.) Notice of fragments of Trilobites of gigantic size in the Cabinet of Julius S. Taylor.

Am. Jour. Sci., ser. 2, vol. 6, p. 431, 1848.

Thomas (H. H.) Fossils of the Oxford Museum IV. Notes on some undescribed Trilobites.

Quart. Jour. Geol. Soc., vol. 56, 1900, p. 616, pls. 34-35.

Phacops (Dalmanites) coronatus n. sp. *Phacops (Dalmanites) nobilis* n. sp. and *Olenus Mitchensini* n. sp.

Thomas (Ivor). Neue Beiträge zur Kenntnis der devonischen Fauna Argentiniens.

Zeitschr. Deutsch. Geol. Ges. lxvii, 1905, pp. 233-290, plates xi-xiv.

Homalonotus Kayseri n. sp. *Phacops argentinus* n. sp. *Dalmanites Drevermanni* n. sp., *D.* sp., *D.* sp. and *Beyrichia argentina* n. sp.

—— New Devonian fossils from Cornwall.

Geol. Mag., Dec. v, vol. vi, No. 3, 1909, pp. 97-102, plate 3.

Phacops (Trimerocephalus) pentops n. sp.

The species was classed under this subgenus on the size of the angle made by the dorsal furrows bounding the glabella, which in the case of Trimerocephalus would be about 50 deg., and Phacops 80-90 deg.

—— A note on *Phacops (Trimerocephalus) laevis* Munster.

Geol. Mag., Dec. v, vol. vi, No. 4, 1909, pp. 167-169.

The author refers the British species *Phacops (Trimerocephalus) laevis* Salter, Decade xi, pl. ix, figs. 1-5, to Salter's name of *Phacops trinucleus.*

—— – Notes on the Trilobite fauna of Devon and Cornwall.

Geol. Mag., Decade v, vol. vi, 1909, pp. 193-204, pl. vii.

Phacops (Trimerocephalus) anophthalmus Frech. *Phacops (Trimerocephalus)* aff. *cryptophthalmus Emm.* as interpreted by Gümbel.

Phacops (Trimerocephalus) tripartitus n. sp. *Proetus dunhevidensis* n. sp. *Dechenella ussheri* n. sp. *Phillipsia minor* H. Woodward.

The name of Dechenella was first employed by Kayser for those members of the Proetidae with very tapering and strongly lobed glabella.

—— A new Devonian Trilobite and Lamellibranch from Cornwall.

Geol. Mag., Decade V, vol. 6, p. 537, pl. 3, 1909.

Phacops (Trimerocephalus) pentops sp. nov.

Toll (Edward von). Beiträge zu Kenntniss des Sibischen Cambrium.

Mem. de l'Acad. Imp. des Science de St. Petersburg, viii ser, vol. 8, 1899, No. x, with plates.

Microdiscus lenaicus n. sp., *M. Kocki* n. sp., *Microdiscus* sp.

Agnostus Schmidti n. sp. *Olenellus* sp. *Agnostus Czekanowski* Schm.

Dorypyge Slatskowskii Schm.

Ptychoparia Czekanowski n. sp., *P. Meglitzkii* n. sp.

Solenopleura ? sibirica Schm.

Bathyuriscus Howelli Walcott.

Anomocare Pawlowski Schm.

Liostracus Maydelli Schm.

The first part of Baron Toll's important contribution to Cambrian literature refers to the earlier work of Dr. F. Schmidt, in which he places some of these fossils as Devonian, but Toll correctly refers them to the Cambrian. One of these is *Doryphyge Slatkowskii*, described under the genus Proetus by Schmidt—the three others are referred to *Anomocare Pawlowskii* Schm., *Liostracus Maydelli* Schm., and *Solenopleura sibirica*, described by Schmidt under the genus Cyphaspis.

On plate 1 are figured some new species of Trilobites from a new locality.

Two minute species are referred to the genus Ptychoparia, which Dr. Matthew, in his review of Toll's paper, remarks might be compared with the Strenuella type of Agraulos.

The Agnostus described as *A. Schmidti* has an unusual association, if occurring in strata with Microdiscus. The Agnostus, however, is flatter than the typical species of the Paradoxides beds, and Dr. Matthew says it may be an earlier form.

Tornquist (S. L.) On the appendages of Trilobites.

Geol. Mag. London, Decade iv, vol. 3, 1896, p. 142.

On *Parabolina spinulosa* Wahlenb. as figured by Linné, Svenska Vet. Akad. Handl., vol. 20, 1759, showing one pair of antennae at their true place.

Linné says: "Fig. 1 is one of the clearest specimens I ever saw among so many thousand. Most remarkable in this specimen are the antennae in front, which I never saw in any other example, and which clearly proves the fossil to belong to the insects."

——— Linné on the appendages of Trilobites.

Geol. Mag., London, Decade iv, vol. 3, 1896, pp. 567-569.

The author does not conform Beecher's suggestion that Linné's figure may be interpreted as the thickened border between the facial sutures, but considers them as true antennae.

——— Fördrojda Paleontologiska meddelanden.

Geol. Fören. Förhandl., No. 238, Bd. 27, Häft. 27, 1906.

Chirurus Clasonii n. sp.

Turner (H.) Trilobites and their modern representatives.

Seventh Ann. Report Proc. Crpyden Micr. Club, 1878, pp. 42-46.

Compares the Trilobites with the living Limulus.

Tullberg (Sven Axel). Skänes Graptoliter.

Sveriges Geol. Undersökning, Ser. C, n. 55, 1883.

On p. 18 the author describes a new *Calymmene dilatata* nov. and *C. trinucleina* Linrs. msc. nov.

The species was afterwards fully described and illustrated by Dr. E. Olin, Meddelande från Lund. Geol. Fältkubb Ser. B, No. 1, 1906, p. 56, plate 2, figs. 10, 11 and 12.

Pompeckj in his reclassification of the Calymmenidae, places this species under the group Synhomalonotus, section *Calymmene Tristani. Calymmene (Synhomalonotus) dilatatus* Tullbg.

Twenhofel (W. H.) The Anticosti Island faunas.

Geol. Sur. Canada Mus. Bull., No. 3, Geol. series, No. 19, October 30, 1914.

The author describes as new *Triarthrus Becki* var. *macastyensis.*

This variety is like *T. Becki* except the facial sutures are slightly more sinuous, and in front they diverge from the axis instead of converging as in *T. Beckii.*

Triarthrus jemtlandicus Lindström has a similar facial suture, though otherwise different.

Ulrich (Edward O.) Ostracoda.

Text Book of Palæontology (Zittel's) translated by C. R. Eastman, London and New York, 1900, pp. 642-648.

——— and **Bassler** (Ray S.) New American Palæozoic Ostracoda. Notes and descriptions of Upper Carboniferous genera and species.

Proc. Natl. Mus., vol. 30, 1906, pp. 149-164, pl. 40.

Paraparchites n. gen., *P. humerosus* n. sp. *Beyrichia ? radiata* J. & K., *B. ? emaciata* n. sp. *Beyrichiella gregaria* n. sp., *B. bolliaformis* n. sp., *B. bolliaformis tumida* n. var. *Kirbya pinguis* n. sp., *K. centronota* n. sp.

ULRICH (E. O.) and BASSLER (Ray S.)—Continued

Cythere ? Haworthi n. sp. *Bairdia Beedei* n. sp. and var. *adrupta.*

Cypridina subovata n. sp.

The genus Paraparchites is closely related to and probably derived from Aparchites. In the latter the ventral edges of the valves meet without appreciable or, at any rate, constant overlap, and it is this difference that is chiefly relied on to distinguish the two genera.

The authors refer the Ordovician species *Aparchites elliptia* Ulrich, to this genus.

——— and Bassler (Ray S.) New American Palæozoic Ostracoda. Preliminary revision of the Beyrichiidæ with descriptions of new genera.

Proc. U. S. National Museum, vol. xxxv, 1909, pp. 277-340, plates 37-44.

New genera: Scofieldia, Treposella, Hollina, Kirbyina, Jonesina.

New subgenus: Steusloffia.

New species: *Beyrichia moodeyi, B. waldronensis, Kloedenia centricornis, K. fimbriata, K. marginalis, K. praenunfia, K. punctillosa, K. retifera.*

New name *Beyrichia granulifera.*

The authors divide the family into 21 genera, as follows:

Beyrichia McCoy emended.

Ordovician species: *Beyrichia (Steusloffia) acuta, (B. erratica* var. *acuta* Krause), *B. (Steusloffia) antiqua, (B. antiqua* Steusloff), *B. granulifera* new name *(Bollia granulosa* Krause), *B. (Steusloffia) Linnarssoni (Strepula Linnarssoni* Krause), *B. (Steusloffia) signata (B. signata* Krause). *Beyrichia tumida (Ctenobolbina tumida* Ulrich), *B. v-scripta (Bollia v-scripta* Krause).

Silurian species: *Beyrichia admixta* Jones and Holl., *B. acquilatera* Hall, *B. Baueri* Reuter, *B. Baueri tripartita* Reuter, *B. (Steusloffia) beyrichiodides (Strepula beyrichiodides* J. & H.), *B. bolliana* Reuter, *B. Bronni* Reuter, *B. Buchiana* Jones, *B. Buchiana angustata* Reuter, *B. Buchiana incisa* Reuter, *B. Buchiana lata* Reuter, *B. Buchiana nutans* Kiesow, *B. clavata* Kolmodin, *B. Damesi* Krause, *B. diffusa* Jones, *B. dubia* Reuter, *B. grandis* Kolm., *B. granulosa* Hall, *B. interrupta (Bollia interrupta* Jones), *B. Jonesii* Boll., *B. Kloedeni* McCoy, *B. Kloedeni acadica* J., *B. Kloedeni antiquata* J., *B. Kloedeni bicuspis* Kiesow., *B. Kloedeni granulata* J., *B. Kloedeni infecta* J., *B. Kloedeni intermedia* Jones, *B. Kloedeni intermedia* sub. var. *subspissa* Jones and Holl., *B. Kloedeni nuda* Jones, *B. Kloedeni protiberans* Boll., *B. Kloedeni subtorosa* J., *B. Kloedeni torosa* Jones, *B. Kloedeni verruculosa* Jones, *B. Kochii* Boll, *B. lata* Hall, *B. lauensis* Kiesow. *B. Lindsromi* Kiesow, *B. MacCoyiana* Jones, *B. MacCoyiana sulcata* Reuter, *B. Moodeyi* n. sp., *B. muldensis* Chapman, *B. nodulosa* Boll, *B. nodulosa expansa (B. Lindstromi* var. *expansa* Kiesow), *B. Noetlingi* Reuter, *B. Noetlingi conjuncta* Reuter, *B. plagosa* Jones, *B. plicata (Entomis plicata* Krause), *B. pustulosa* Hall, *B. reticulata (Strepula reticulata* (limbata in text) Krause), *B. Reuteri* Krause, *B. salteriana* Jones, *B. scanensis* Kolmodin, *B. (Steusloffia) simplex (Strepula simplex* Krause), *B. spinulosa* Boll, *B. Steusloffi* Krause, *B. trilobata (Entomis trilobata* Krause), *B. tuberculata (Battus tuberculatus* Kloeden), *B. tuberculata bigibbosa* Reuter, *B. tuberculata foliosa* Jones, *B. tuberculata spicata* Jones, *B. tuberculata Kockiana* Reuter, *B. umbonata (B. bolliana umbonata* Reuter), *B. waldronensis* n. sp.

Devonian species: *Beyrichia aurita* Richter, *B. devonica* J. & W., *B.* new species *(B. Kloedeni* var. Jones).

Of the 225 named species and varieties, varying in time from the Cambrian to the Permian, and referred to the genus Beyrichia, only 73 species and varieties listed above are referred to the genus.

The authors places under Group *Beyrichia Kloedeni:*

Beyrichia Kloedeni, B. MacCoyiana, B. Bolliniana, B. Kockii, B. tuberculata-Kockiana, B. Moodeyi and *B. Lindstromi.*

ULRICH (E. O.) and BASSLER (Ray S.)—Continued

The valves are usually short, semi-elliptical in outline, and sharply lobed.

Group *Beyrichia Buchiana:*

The anterior and median lobes are joined, but the anterior lobe is thinner and the ventral connection proportionally thicker than usual, the combination giving to the united lobes a striking similarity to the horseshoe ridge in the *B. ungula* section of Bollia.

Group *Beyrichia tuberculata:*

This section comprises a number of species, in which the anterior and posterior lobes are broken up by minor furrows—the posterior lobe into 2, the anterior lobe into from 2 to 6 or 7 node-like parts. *Beyrichia Buchiano-tuberculata* Reuter, would represent about the simplest type, and *B. pustulosa* Hall and *B. Noetlingi* Reuter the most complex.

Group *Beyrichia Salteriana:*

The species of this group are not as large as those of the preceding groups and differ in the fullness of their lobes and proportionate narrowness of the furrows.

Group *Beyrichia clavata:*

The small group includes *B. Jonesii* Boll, and possibly *B. umbonata* Reuter.

Subgenus *Steusloffia,* new.

Group *Beyrichia Linnarssoni:*

This group includes *B. antiqua, B. acuta, B. simplex, B. Linnarssoni, B. signata, B. beyrichiodes* and probably *B. erratica* Krause.

Group *Beyrichia interrupta:*

The illustrations given by the authors show possible derivation of the *B. interrupta* group from Eurychilina, and its relations to *Beyrichia clavata* group and to Steusloffia.

The authors place under Kloedenia the following species:

Kloedenia apiculata Jones, *K. Barretti (Beyrichia Barretti* Wel.), *K. centicornis* n. sp., *K. concinna (Beyrichia concinna* J. & H.), *K. fimbriata* n. sp., *K. granulata (Beyrichia granulata* Hall), *K. initialis (Beyrichia initialis* Ulrich), *K. intermedia (B. intermedia* J. & H.), *K. intermedia marginata* J. & H., *K. jerseyensis (Beyrichia jerseyensis* Weller), *K. Kummeli (Beyrichia Kummeli* Weller), *K. manliensis (Beyrichia manliensis* Wel., *K. manliensis deckerensis (Beyrichia deckerensis* Weller), *K. marginalis* n. sp., *K. montaguensis (Beyrichia momtaguensis* Wel.), *K. nearpassi (Beyrichia nearpassi* Weller), *K. oculina (Beyrichia oculina* Hall), *K. parasitica (Beyrichia parasitica* Hall), *K. praenuntica* n. sp., *K. punctillosa* n. sp., *K. retifera* n. sp., *K. scotica (Beyrichia Kloedeni* var. *scotica* J. & H.), *K. simplex* Jones, *K. Smocki (Beyrichia Smocki* Weller), *K. sussexensis (B. sussexensis* Weller), *K. tuberculata (Beyrichia tuberculata* Salter), *K. wallpackensis (Beyrichia wallpackensis* Weller), *K. Wilckensianna (Beyrichia Wilckensianna* Jones), *K. Wilckensianna plicata (Beyrichia Wilckensianna plicata* Jones).

Of the above species *K. initalis* and *K. praenuntia* are Middle Ordovian and *K. simplex* late Devonian. All the others Silurian.

The genus Kyammodes Jones is closely allied, distinguished chiefly by the much greater inequality of its valves, the thick ventral edge of the right overlapping the smaller left valve. There are some peculiar differences in lobation also.

Tetradella Genotype *T. quadrilirata* H. & W.

List of Ordovician species:

Tetradella ? affinis (Beyrichia affinis Jones), *T. bohemica (Beyrichia bohemica* Barr. MSS. Jones), *T. hussacensis (B. hussacensis* Jones), *T. carinata (B. carinata* Krause), *T. complicata (B. complicata* Salter), *T. complicata decorata (Beyrichia complicata* var. *decorata* Jones), *T. ? digitata (Beyrichia digitata* Krause), *T. ? digitata separata (Beyrichia digitata* var. *separata* Steusloff), *T. (Kiesowia) dissecta (Beyrichia dissecta* Krause), *T. ? erratica (Beyrichia erratica* Krause), *T. harpa (B. harpa* Krause), *T. ?*

ULRICH (E. O.) and BASSLER (Ray S.)—Continued

lacunata (Beyrichia lacunata J. & H.), *T. (Kiesowia) mamillosa (Beyrichia mamillosa* Krause), *T. marchica (B. marchica* Krause), *T. marchica angustata (B. marchica* var. *angustata* Krause), *T. marchica lata (B. marchica* var. *lata* Krause), *T. palmata (Beyrichia palmata* Krause), *T. quadrilirata (Beyrichia quadrilirata* H. & W.), *T. (Kiesowia) radians (B. radians* Krause), *T. ribeiriana (B. ribeiriana* Jones), *T. simplex (T. quadrilirata* var. *simplex* Ulrich), *T. subquadrans* Ulrich.

Ceratopsis Genotype *Beyrichia Chambersi* Miller.

The genus includes *C. robusta* Ulrich, *C. intermedia* Ulrich, *C. oculifera* Hall, all Upper Ordovician species, and *C. hastata (Beyrichia hastata* Barr.)

Stenobolina Genotype *Beyrichia ciliata* Emmons.

Group of *Ctenobolina ciliata.*

Ordovician species:

Ctenobolina alata Ulrich, *C. bispinosa* Ulrich, *C. ciliata* Emmons, *C. curta (C. ciliata* var. *curta* Ulrich), *C. Duryi (Beyrichia Duryi* Miller), *C. emaciata (C. ciliata* var. *emaciata* Ulrich), *C. Guillieri (B. Guillieri* Tormelin), *C. Hammelli (B. Hammelli* Miller and Faber), *C. obliqua* Ulrich, *C. oblonga (Entomis oblonga* Steusloff).

Silurian species:

Ctenobolina granosa Ulrich, *C. punctata* Ulrich.

Devonian species:

Ctenobolina papillosa Ulrich.

Group of *Ctenobolina subcrassa.*

Ordovician species:

Ctenobolina crassa Ulrich, *C. fulcrata* Ulrich, *C. impressa (Entomis impressa* Steusloff), *C. major (Bollia major* Krause), *C. minor (Bollia minor* Krause), *C. subcrassa* Ulrich, *C. umbonata (Entomis umbonata* Steusloff).

Silurian species:

Ctenobolina auricularis (Bollia auricularis Jones).

Devonian species:

Ctenobolina mimima Ulrich.

Mississippian species:

Ctenobolina loculata Ulrich.

Drepanella. Genotype *D. crassinoda* Ulrich.

Ordovician species:

Drepanella ampla Ulrich, *D. bigeneris* Ulrich, *D. crassinoda nitida* Ulrich, *D. elongata* Ulrich, *D. macra* Ulrich, *D. Richardsoni (Beyrichia Richardsoni* Miller), *D. Richardsoni canadensis* Ulrich.

This wholly American genus is remarkable for the extreme variability of the nodes within the central area of the valves.

Scofieldia new genus. *Genotype Drepanella bilateralis* Ulrich.

Treposella nov. gen. genotype *Beyrichia Lyoni* Ulrich. This genus proposed for a link in the evolution of Hollina from Beyrichia.

Hollina new genus. Genotype *Ctenobolina insolens* Ulrich.

Devonian species:

Hollinia antespinosa Ulrich, *H. armata* Ulrich, *H. cavimarginata* Ulrich, *H. informis* Ulrich, *H. spiculosa* Ulrich.

All these species were described as species of Ctenobolina by Ulrich.

Carboniferous species:

Hollina granifera (Bollia granifera Ulrich), *H. radiata (Beyrichia radiata* J. & K.), variety *cestriensis* Ulrich, *H. longispina (Beyrichia longspina* J. & K.), *H. emaciata (Beyrichia ? emaciata* U. & B.).

The authors include under this genus *Beyrichia Kolmodini* and *B. tricollina* Ulrich.

ULRICH (E. O.) and BASSLER (Ray S.)—Continued

Kloedenella new genus. Genotype *Kloedenia Pennsylvanica* Jones.

The genus includes some 8 to 10 species, two of them probably only varieties ranging in time from the Clinton to Middle Devonian. The British species *Beyrichia ? bicaesa* J. & K., may be included.

This genus is divisable into two sections:

In the first, the genotype, the posterior and median furrows are shorter than in section number 2, and the anterior furrow either wanting or more or less well-developed.

In the 2nd section, of which *Beyrichia Halli* Jones, is a good example, the posterior and anterior furrows are long, subequal and extending nearly or quite across the valve.

Kirkbyina new genus. Genotype *Beyrichiella ? reticosa* Jones and Kirkby.

Kirkbyina resembles Primitia, but is readily distinguished by its overlapping valves and thicker anterior end.

Beyrichiella J. & K. Genotype *B. cristata* J. & K.

The shell is relatively longer than that of Kirkbyina, and its larger valve is not the right, as in that genus, but the left.

The authors include under Beyrichiella *B. cristata* and *Kirkbyina annectens* the type of Synaphe Jones and Kirkby, also *Ulrichia confluens* Ulrich.

The generic term Synaphe was used by Huebner, therefore preoccupied.

Beyrichiopsis J. & K. Genotype, *B. fimbriata* J. & K.

Other typical species are the Carboniferous species:

Beyrichiopsis cornuta, B. subdentata, B. fortis, B. granulata and *B. simplex,* all described by Jones and Kirkby.

Jonesina new genus. Genotype *Beyrichia fastigiata* J. & K

The following species are referred to *Jonesina Beyrichia arcuata* Bean: *B. Bradyana* J. & K., *B. craterigera* Brady MS. J. & K., *B. fodicata* J. & K. *Carboniferous* species, also *Beyrichiella bolliaformis* var. *tumida* and *B. gregaria* Ulrich and Bassler.

——— Ostracoda.

Geol. Sur. Maryland Lower Devonian, Baltimore, 1913, pp. 513-542, pls. 97-98.

The following species are described:

Leperditia altoides Weller, 1903, *L. elongata* Weller, 1903, *L. gigantea* Weller, 1903. *Aparchites Gordoni* n. sp. *Primitia postturgida* n. sp., *P. ? cumberlandica* n. sp., *P. ? concentrica* n. sp.

Primitiella variolata n. sp. *Ulrichia aequalis* n. sp. *Strepula irregularis* Jones and Holl, 1886. *Halliella seminulum* var. *longa* n. var., *H. ? triplicata* n. sp. *Aechimina cuspidata* Jones and Holl, 1869.

Mesomphalus n. gen.

Carapace of medium size, 1 mm. to 2½ mm. in length, equivalved; valve moderately convex, oblong, subquadrate in outline, with a small ventral pit lying between two rather small rounded nodes; edges of valves rather thick, usually concealed by a flat border, which overhangs it; ventral pouch somewhat elongated, sausage-shaped, occupying nearly the full length of the ventral side.

Type *Mesomphalus hartleyi* n. sp., *M. submarginata* n. sp.

Ctenobolbina denticula n. sp., *C. dubia* n. sp. *Bollia americana* n. sp., *B. curta* n. sp., *B. irregularis* n. sp., *B. jugalis* n. sp., *B. ungula* Jones, 1891. *Kloedenia centricornis* Ulrich and Bassler, 1908, *K. fimbriata* U. & B., 1908, *K. nearpassi* Weller, 1903, *K. Kümmeli* Weller, 1903, *K. sussexensis* Weller, 1903, *K. Barretti* Weller, 1903, *K. Pennsylvanica* Jones, 1889, *K. Clarkei* Jones, 1890, and var. *paupera* U. & B., 1908, *K. turgida* U. & B., 1908, for *K. Pennsylvanica* Jones, in part, 1889, figs. 8 and 9, not figs. 5 and 7; also var. *ventrosa* U. & B. for *K. Pennsylvanica* Jones, 1889, figs. 7 a-b, not figs. 5, 6, 8 and 9.

ULRICH (E. O.) and BASSLER (Ray S.)—Continued

Thlipsura multipunctata n. sp. *Octonaria angulata* n. sp., *O. inequalis* n. sp., *O. simplex* Krause, 1891.

Craterellina n. gen.

The most obvious characteristic of the genus is the presence of a crater-like depression, bordered by a more or less distinctly elevated rim, occupying the anterior one-third or one-half of each valve.

Craterellina robusta n. sp., *C. oblonga* n. sp.

Bythocypris punctatulata var. *arctatum* n. var. *Pontocypris arcuata* n. sp., *P. mawii* var. *breviata* Jones, 1889, and *Pachydomella longula* n. sp.

Van Ingen (Gilbert). The Silurian fauna near Batesville, Arkansas. School of Mines Quart., vol. 23, 1901, No. 1.

The author refers to certain plates which were not issued with the publication.

The author remarks on the family Acidaspidae Barr. (used for the xii family, without a family name), that this term is used in preference to Odontopleuridae of Burmeister (used by this author for a family name), which latter name had more recently been suggested by Etheridge and Mitchell in 1897, inasmuch as the genus Acidaspis Murch. (January, 1839,) and Emmrich's name Odontopleura (1839) is of later date. There was no date of publication given on Emmrich's De. Trib. Dissertates.

The author refers to Murchison's Acidaspis, on p. 55, as a similar genus.

The author quotes Barrande, Vogdes and Clarke on the family and gives figures of *Odontopleura ovata, Selenopeltis Buchi, Ceratocephala prevosti* and *C. Danai, Dicranurus humatus* and *Acidaspis Brighti* in the text. The author describes seven species from the Niagaran limestone of St. Clair Springs.

Odontopleura Ortonti Foerste, *O. arkansana* nov. with fig. in text.

Ceratocephala gonita Warder *(depauperata), C. nodulata* nov., fig. of head in text, *C. coalescens*, fig. glabella in text.

Acidaspis quinquespinosa Salter MS., fig. 12 head in text.

The unpublished plates of Acidaspis Salter and Fletcher (two plates), the second one (figs. 10-12) of *Acidaspis quinquespinosus* nov. of a small head with spined occipital ring, and an entire specimen (fig. 12) with a median node to the occipital ring. Van Inger's figure is more in keeping with Lake's fig., pl. 7, fig. 4.

Acidaspis obsoleta nov., figs. 13 and 14 in text.

Ampyx niagarenis nov., fig. 15 in text, compares *A. parvulus* Forbes, differs in its longer and narrower glabella, and less tumid cheeks.

Proetus corrugatus nov., figs. 16-17 in text, head and tail; *P. subanulatus* nov., fig. 18 in text, tail.

Arges phyctenoides Green, depauperatus.

The author uses the preoccupied term Arges referred by Gurich to Ceratages.

Van Ingen places *Lichias Hanovensis* Miller and Gurley and *L. Byrneansus* M. & G. as syn. to Green's species.

Arges arkansanus nov., fig. 19 in text, head compares *Lichas Grayi* Fletcher. *Lichas nereus* Hall.

Encrinurus punctatus Wahl., refers *E. ornatus* H. & W., to this.

Dalmanites (Synphoria) viglans Hall, *D. (Synphoria) arkansanus* nov., figs. 20-22, heads and tail, broad and narrow forms.

These forms differ in the well-marked triangular outline of both cephalon and the frontal glabellar lobe, of the American Ordovician and Silurian species. Their nearest ally appears to be *Phacops Brongniartii* Portlock, which has been referred to the subgenus Pterygometopus.

Vogdes (A. W.) Notes on Palæozoic Crustacea, No. 5. Carboniferous Trilobites from Missouri.

Proc. Cal. Acad. Sci., 2nd ser., vol. 6, 1896, p. 197, fig. in text.

Proetus ? placidus nov.

This species from Chouteau limestone of Sedalia has the lateral lobes of the pygidium smooth, similar to the Silurian species of France named by Rouault *Calymmene Arago* and *C. Salteri*, although it belongs to a different group of the Proetidae, with only nine thorax segments. The head is parabolic in form, genal angles rounded. The eyes are similar in location to those of *Phillipsia Sampsoni* from the same locality. The tail has eight axial joints with indications of two faintly defined segments on the lateral lobes.

——— The genus Encrinurus: its history, its species, its proper division in the family of Trilobites.

Trans. San Diego Soc. Nat. Hist., vol. 1, 1907, No. 2, pp. 61-82, plates 1-3.

The author divides the family into two divisions:

Encrinurus. Genotype *E. punctatus* Wahl.

Cryptonymus. Genotype *C. variolaris* Brong.

Although Eichwald used this term in 1825 for certain Asaphidae and Illaenidae, he used the same term in 1840 for such species as *Calymmene punctatus* and *C. variolaris*, which was adopted by Angelin. The term should stand under the strict rule of priority for the second use of the term.

Cryptonymus Eichwald, 1840.

The author uses it for the second species included by Eichwald in 1840. Figures and descriptions of *Encrinurus punctatus* Walh., *E. vigilans* Hall, *E. ornatus* H. & W., *E. Threcheri* Foerste, *E. Trentonensis* Walc., *E. nereus* Hall, *E. Eagani* Miller, *E. Americanus* Vogd., *E. sex-costata* Salt., *E. delitides* Shumard, *E. Barrandei* DeKon., *E. Mitchelli* Foerste, *E. schisticola* Törnq., *E. Seebachi* Schm., *E. multi-segmatus* Portl., *E. fallax* Reed, as given.

Under the genus Cryptonymus the author includes *Cryptonymus variolaris* Brong., *C. expansa* Hasw. Henderson, 1868, refers the free cheeks of *Zethus Payeii* Haswell, to *E. expansus*. *C. obtusus* Ang., *E. raricostatus* Wal., *C. laevis* Ang., *Encrinurus Bowningi* Foerste, *E. tuberculatus* Collie.

Certain species described by Barrande under the genus Cromus have been referred by Novak to the genus Encrinurus on account of the direction of the facial sutures, which are the same in both genera. They are *Cromus Beaumonti, C. Bohemicus, C. transient* and *C. intercostatus*. The *Encrinurus Novaki* Frech, has been referred to *Encrinurus Beaumonti* var., *Novaki* by Gornani and Le Regny.

Remarks the name of *Encrinurus punctatus* has often been applied to a common Scandinavian species, first illustrated by Wahlenberg in an advanced publication of his paper in 1818. Petrificata telluris Svencanae, Brunnich's fossil from Bohemia, from a soft yellow limestone, may be the *Cromus Beaumonti* Barr. The author remarks, in his paper, on two very imperfect petrified impressions of this fossil, that it had across the fossil body impressed spotted rings, which marks are sufficient to distinguish them from other species. The size of it seems to vary greatly, as my collection contains one small and one very large back part of this species; each has 18 joints. The only Bohemian Encrinuridæ recorded are those described under Cromus by Barrande and Novak.

Verneuil (E.) Observations sur la description de quelque Trilobites russes par M. A. de Volborth.

Bull. Soc. Geol. de France, 2nd ser., vol. 5, 1848, p. 384.

Review of Dr. Volborth's paper on the genus Zethus.

Wade (A.) On the Llandovery and associated rocks of Northeastern Montgomeryshire.

Quart. Jour. Soc. London, vol. 67, No. 267, 1911, p. 415, plates 33-36.

Notes on the Palæontology of the area 1—Trilobita.

The author describes the following species:

Trinucleus intermedius sp. nov.

Refers *T. concentricus* Hall, Pal. N. Y., vol. 1, p. 249, pl. 65, figs. 4a-4c; also p. 255, pl. 67, figs. 1a-h, to the new species.

Dionide sp.

Ostracoda Melanella n. gen.

The author gives the following description of the genus:

Carapace small; equivalves moderately convex, subcircular, rather flattened anteriorly; hinge straight; valves with a small, faintly raised horseshoe ridge confined to the posterior half, enclosing a small semicircular sulcus; edges simple.

The genus is closely allied to Jonesella of Ulrich.

Melanella hemidiscus gen. et sp. nov.

Primitiella unicornis Ulrich. *Primitia Ulrichi* Jones, *P. tumidula* Ulrich. *Ctenobolina* cf. *ciliata* Emmons. *Bolla lata* V. & H. *Krausella arcuata* Ulrich.

Walcott (Charles D.) Description of new genera and species of fossils from the Middle Cambrian.

Proc. U. S. Natl. Mus., vol. 11, 1888, Washington, 1889, pp. 441-446.

The author includes under the genus *Dorypyge* the following species:

D. richtofeni with *Olenoides nevadensis, O. quadriceps, O. wasathchensis* and *O. curticei*—a new species which he illustrates on p. 444, fig.; also the new genus *Karlia*, named in honor of Dr. Karl Rominger.

Genotype Karlia minor n. sp.

The author refers *Menocephalus salteri* Rominger, 1887, Proc. Acad. Nat. Sci., pt. 1, p. 16, pl. 1, fig. 6, to a new species: *Karlia stephenensis.*

The Bathyurus Rominger, Proc. Acad. Nat. Sci. Phila., pt. 1, pl. 18, fig. 8, is referred to *Bathyuriscus (Kootenia) dawsoni* n. sp.

A new genus, Ogygopsis, is founded on the species *Ogygia Klotzi* Rominger, it differs from Ogygia in having a well-defined ocular ridge, and in the narrow palpebral lobe.

——— Cambrian Fossils, Yellowstone National Park.

Mong. U. S. Geol. Survey, No. 32, part 2, pp. 440-478, plates, 1899.

Agnostus interstrictus White, *A. bidens* H. & W., *A. tumidosus* H. & W.

Ptychoparia Penfieldi n. sp., *P. antiquata* Salt., *P. (Euloma) affinis* Walc., *P. Llanoensis* Walc., *P.* sp. *Crepicephalus Texanus* Shumard, *P. (Lonchocephalus) hamulus* Owen, *P. (Lonchocephalus) Wisconsensis* Owen, *P. ? diademata* Hall.

Arionellus levis n. sp. *Arionellus* sp. *Liostracus parvus* n. sp. *Solenopleura Weedi* n. sp. *Zacanthoides* sp. *Bathyuriscus* sp.

——— Precambrian fossiliferous formations.

Bull. Geol. Soc. Amer., vol. 10, pp. 189-244, 1899, plates.

Beltin Danai n. gen. et sp.; also figures of Pterygotus, Eurypterus, Slimonia and Stylonurus for comparison.

The author refers to the genus Beltina certain fragmentary remains of a crustacean collected from the calcareous Greyson shales of Montana, and remarks, as far as can be judged from what we now know of it, is referable to the Merostomata.

WALCOTT (Charles D.)—Continued

——— *Asaphus Emoryi* Hall. Description and figure of in Palæontologia.

Universalis Fasc. 11, plate 28, 1904.

——— The Cambrian fauna of India.

Proc. Washington Acad. Sci., vol. 7, 1905, pp. 251-256.

Notes on the genus *Redlichia Noetlingi* Redlich. *Ptychoparia Richeri* Redlich, *P. Warthi* and *Olenus indicus.*

— —— Cambrian faunas of China.

Proc. U. S. Natl. Mus., vol. 29, 1905, pp. 1-106.

Trilobita: *Agnostus Kusanensis* n. sp. *Microdiscus orientalis* n. sp. *Redlichia chinensis* n. sp., *R. finalis* n. sp., *R. nobilis* n. sp. *Redlichia* sp. *Olenoides ? cilix* n. sp. *Dorypyge bispinosa* n. sp. *Dorypygella typicalis* n. gen. et sp.

The genus is characterized by the peculiar glabella, narrow frontal margin, and spinose pygidium.

Dorypygella alcon n. sp., *D. alastor* n. sp.

The *Dorypygella typicalis* is a synonym of *Teinistion Lansi* Monke. *Damesella Blackwelderi* n. gen. et sp.

The genus differs from Dorypyge in the character of the head, as far as known. The thorax and pygidium are essentially of the same type. The pygidium of Damesella is of the type of Olenoides and the pleural lobes of the thoracic segments are also of the same type, but the thorax of Olenoides has eight segments, and a strong median spine on the axis, while the thorax of Damesella has twelve or more segments and without a median spine.

Damsella nov. gen. genotype, *D. Blackwelderi* Walcott.

Damesella bellagranulata n. sp., *D. brevicauda* n. sp., *D. chione* (a syn. of *Stephanocare Richthofeni* Monke), *D. sinensis* Bergeron. *Dicellocephalus sinensis.*

Agraulos abaris n. sp., *A. abrota* n. sp., *A. acalle* n. sp., *A. agenor* n. sp., *A. dirce* n. sp., *A. divi* n. sp., *A. dolon* n. sp., *A. dryas* n. sp.

Anomocare alcinoe n. sp., *A. Bergioni* n. sp., *A. bianos* n. sp., *A. biston* n. sp., *A. ? butes* n. sp., *A. ? daulis* n. sp., *A. daunus* n. sp., *A. decelus* n. sp., *A. tatian* n. sp., *A. temenus* n. sp.

Anomocarella chinensis n. gen. et sp.

The genus differs from Anomocare in the absence of glabella furrows and the presence of a relatively narrow, flattened frontal rim.

Anomocarella baucis n. sp., *A. albion, A. carne* n. sp.

Arionellus agonius n. sp., *A. ajax* n. sp., *A. alala* n. sp.

Menocephalus acerius n. sp., *M. agave* nov., *M. Velenus* nov. n. sp., *M. ? depressus* n. sp.

Pagodia lotos n. gen. et sp.

This genus differs from Dolichometopus in the narrowing instead of widening of the glabella in front; in the presence of small instead of large eye-lobes, short instead of long postero-lateral limbs, and obscure glabellar furrows.

Pagodia bia n. sp., *P. dolon* n. sp., *P. macedo* n. sp., *P. lotos* n. sp.

Pterocephalus asiatica n. sp., *P. busiris* n. sp.

Ptychaspis acamus n. sp., *P. cacus* n. sp., *P. cadmus* n. sp., *P. calchas* n. sp., *P. callisto* n. sp., *P. calyce* n. sp., *P. campe* n. sp., *P. ceto* n. sp., *P.* sp.

Ptychoparia aclis n. sp., *P. ? batia* n. sp., *P. ? bromus* n. sp., *P. ceus (Liostracina Krausei* n. sp., Monke), *P. constricta* n. sp., *P. dryope* n. sp., *P. granulosa* n. sp., *P. impar* n. sp.; also var. *P. ligea* n. sp., *P. mantoensis* n. sp., *P. tellus* n. sp., *P. tenes, P.* sp., *P. titiana* n. sp., *P. theano* n. sp., *P. tolus* n. sp.

WALCOTT (Charles D.)—Continued

Ptychoparia (Liostracus) toxeus n. sp., *P. (Liostracus) trogus* n. sp., *P. (Liostracus) tutia* n. sp.

Proampyx subgen. of *Ptychoparia* (name used by Frech, 1902, Lethaea Geol., 1 Theil Leathaea Pal. 11, p. 66, for *Anomocare acuminatum* Ang.).

Ptychoparia (Proampyx) hurea n. sp.

Shantungia spinifera n. gen. et sp. *Solenopleura alderus* n. sp., *S. acantha* n. sp., *S. acidalia* n. sp., *S. agno* n. sp., *S. belus* n. sp., *S. heroe* n. sp.

Dikelocephalus ? haubo n. sp., *D. ? brizo* n. sp. *Crepicephalus damia* n. sp., *C. magnus* n. sp.

Dolichometopus alceste n. sp., *D. deois* n. sp., *D. derceto* n. sp., *D. dirce* n. sp.

Illaenurus canens n. sp., *I. ceres* n. sp., *I. dictys* n. sp.

Ostracoda: *Bradoria Bergeroni* n. sp., *B. enyo* n. sp., *B. eris* n. sp., *B. fragilis* n. sp., *B. sterope* n. sp., *B. Woodi* n. sp.

——— Cambrian faunas of China.

Proc. U. S. Natl. Museum, vol. 30, 1906, pp. 563-595.

Blackwelderia n. gen. *Dorypyge Richthofeni laevis* n. var. *Blackwelderia cilix* Walc. Genotype *B. sinensis* Bergeron.

Agraulos armatus n. sp., *A. nitida* n. sp., *A. obscura* n. sp., *A. regularis* n. sp., *A. uta* n. sp., *A. vicina* n. sp., *A. ? capax* n. sp., *A. ? melie* n. sp.

Anomocare Bigsbyi n. sp., *A. eriopia* n. sp., *A. flava* n. sp., *A.* sp. ?

Anomocarella contigua n. sp., *A. irma* n. sp.

Ptychaspis bella n. sp.

Ptychoparia comus n. sp., *inflata* n. sp., *P. Lilia* n. sp., *P. nereis* n. sp., *P. undata* n. sp., *P. vesta* n. sp., *P.* sp. ? *P. ? Maia* n. sp., *P. (Liostracus) intermedia* n. sp., *P. (L.) subrugosa* n. sp.

Solenopleura pauperata n. sp.

Dolichometopus hyrie n. sp.

——— Cambrian Geology and Palæontology, No. 5. Cambrian sections of the Cordilleran area.

Smithsonian Miscellaneous Collections, vol. 53, Dec. 10th, 1908.

The names of some new species are given, but without descriptions.

——— Mount Stephen rocks and fossils.

Canadian Alpine Journal, vol. 1, No. 2, pp. 232-248, 4 plates, 1908.

The author illustrates *Olenellus Gilberti* Meek. *Anomolocaris ? Whiteavesi* n. sp., *A. Canadensis* Whiteaves, *A. ? acutangulus* n. sp. *Oryctocephalus Reynoldsi* Reed. *Bathyuriscus occidentalis* Matt., *B. ornatus* Walc. *Karlia stephensis* Walc., *Ptychoparia cordillerae* Rominger, *P. palliseri* n. sp. *Agnostus montis* Matt. *Burlingia Hectori* Walc. *Dorypge (Kootenia) Dawsoni* Walc. *Zacanthoides spinosus* Walc. *Bathyuriscus rotundatus* Rominger. *Neolenus serratus* Rominger. *Ogygopsis Klotzi* Rominger.

No description of the species was given.

——— Cambrian Geology and Palæontology, No. 2. Cambrian Trilobites.

Smithsonian Misc. Collections, No. 1805, vol. 53, 1908.

Burlingidae: This family includes the genera Burlingia and Schmalenseeia. The genotype of the genus is *Burlingia Hectori* Walcot. The facial sutures and free cheeks relate *Burlingia* to some forms of the Cheiruridae, while the pygidium of Burlingia recalls the simple pygidium of Paradoxides, and the pygidium of *Schmalenseeia* recalls that of Amphion.

WALCOTT (Charles D.)—Continued

Albertella n. genus, Genotype *A. Helena* n. sp.

The genus should be compared with the genus Zacanthoides. The cephalons of the two genera are generically the same. The thoracic segments are the same type, but the third or fourth segment of the thorax of Albertella is extended into long pleural spines, and the thorax has seven instead of nine segments as in Zacanthoides. The pygidium has one pair of spines instead of many spines, as in Zacanthoides.

Albertella Bosworthi n. sp.

Oryctocare new genus, genotype *O. Geikiei* n. sp.

The cranidium of the cephalon of this genus is much like that of Oryctocephalus, but the thorax and pygidium are unlike. The pleurae are of the *Olenus* type, while the pygidium is broad and of the Bathyuriscus type.

Zacanthoides idahoensis n. sp. *Neolenus inflatus* n. sp., *N. intermedius* n. sp., *N. intermedius pugio* n. variety, *M. superbus* n. sp.

Bathyuriscus ornatus n. sp.

——— Middle Cambrian Merostomata.

Smithsonian Mis. Coll., vol. 57, No. 2, Washington, 1911.

In this paper two genera, Sidneyia and Amiella, are described.

Sidneyia inexpectans Walc. *Amiella ornata* Walc. *Neolenus serratus* Rominger. *Beltins Danai* Walc.

The new genera are placed in a new sub-order Limulava of the order Eurypterida.

Sidneyia with its four pairs of cephalo-thoracic appendages and simple antennae approaches the Trilobita, which has a similar scheme of cephalic appendages.

——— Cambrian Geology and Palæontology, No. 6. Olenellus and other genera of the Mesonacidæ.

Smithsonian Misc. Collections, vol. 53, No. 6, 1910, pp. 231-422, Pls. 22.

The author under the family Mesonacidae places:

1. Nevadia n. gen. genotype *N. Wetksi* n. sp.

In the type of this genus the posterior 11 segments have only the axial lobe and a spinose continuation on each side. The spinose extensions of the posterior segments are proportionally much rounder and smaller than those of the anterior 17 segments. The pygidium is small without pleural lobes and transverse furrows.

2. Mesonacis: This form is essentially the same as Elliptocephala, but it has an enlarged third segment in the adult, and a strong spine on the fifteenth segment.

The species referred to Mesonacis are *M. vermontana* Hall, *M. Mickwitzi* Schmidt, and *M. Torrelli* Moberg.

Elliptocephala Emmons, genotype *E. asaphoides* Emmons.

In the genus the posterior five segments are more highly developed than the primitive segments of Nevadia, but not as much so as the segments anterior to them.

Callavia Matthew, genotype *Olenellus (Holmia) bröggeri* Walcott.

This genus was proposed by Matthew, Am. Geol., vol. 19, p. 397, 1897, for *O. bröggeri* and *O. callavii* Lapw., on acccount of the glabella differing from that of *Olenellus (Holmia) Kjerulfi.*

Callavia has a trace of the constricted pleurae of the posterior portion of the thorax in the two last segments. The broad thorax of Callavia with the falcate extensions of the pleurae are unlike the narrow thorax of Holmia, with its spinos pleural extensions.

The glabella of Callavia is narrower and more primitive, and its intergenal spine is less primitive. The pleural furrow of Callavia is narrow and oblique, like that of Paradoxides, while the pleural furrow of Holmia and Wanneria is broad and straight.

The segments of Callavia appear to be nearer to Elliptocephala, than to those of Holmia.

WALCOTT (Charles D.)—Continued

The following species are referred to the genus: *Callavia bicensis* Walc., *C. bröggeri* Walc., *C. burri* Walc., *C. callavei* Lapw., *C. cortlandi* Raw. Mss., *C. crosbyi* Walc. and *C. nevadensis* Walc.

Holmia Matthew genotype *Paradoxides Kjerulfi* Linnarsson, 1871.

The species referred to Holmia are *H. kjerulfi, H. lundgreni* and *H. rowei* Walc., the only American species.

Wanneria new genus. Genotype *W. Walcottanus* Wanner.

This genus has a uniform series of thoracic segments, with pleurae terminating in broad falcate extensions beyond the body line, without the spinose ends as in Holmia.

The species referred to Wanneria are: *W. Walcottanus* Wanner, *W. gracile* Walc. and *W. Halli* Walcott.

Paedeumias n. gen. Genotype *P. transitans* Walcott.

The distinctive characters of the genus are in the presence of the rudimentary segments and pygidium.

Olenellus Hall. Genotype *O. Thompsoni* Hall.

The author remarks that *Olenellus Thompsoni* passes through a *Holmia* and *Paedeumias* stage before becoming a true *Olenellus.*

The American species are *Olenellus Thompsoni* Hall and variety *O. crassimarginatus* Walcott, *O. gilberti* Meek, *O. fremonti* Walc., *O. canadensis* Walc., *O. claytoni* Walc., *O. argentus* Walc., *O. walcotti* S. & F.

The European species are *O. gigas* Peach, *O. lapworthi* Peach, *O. reticulatus* Peach and *Olenellus* n. sp. undt.

All these species have telsonated pygidia and may be classed under the family name of Olenellidae.

Peachella new genus. Genotype *P. iddingsi* Walcott.

The genus is only known by the head, which has blunt, tumid genal spines; elongated, narrow glabella; small eyes and marked convexity.

Olenelloides Peach. Genotype *O. armatus* Peach.

This genus is clearly defined by its large cephalon and primitive thorax and pygidium. The author remarks it is essentially a larval form of *Olenellus.* The author diagrammatically represents these Lower Cambrian genera under the family of *Mesoncidae.* Left-hand branch Nevadia, Callavia, Holmia, Wanneria,—Paradoxides. Right-hand branch Nevadia, Mesonacis, Elliptocephala, Paedeumias, Olenellus, Peachella—Ollenoides.

——— Cambrian Geology and Palæontology, No. 7. Cambro-Ordovician boundary in British Columbia, with description of Fossils.

Smithsonian Mis. Coll., vol. 57, No. 7, 1912.

The author describes *Certopyge canadensis* n. sp.

This species differs from *C. forficula* Sars in the greater length of the frontal limb of the cranidium, longer palebral lobes and narrower fixed cheeks, etc.

——— Cambrian Geology and Palæontology—2, No. 6. Middle Cambrian Brachiopoda, Malacostraca Trilobita and Merostoma, with plates 24 to 34.

Smithsonian Misc. Coll., vol. 57, No. 6, 1912.

Under the class Malacostraca, the author describes the following species:

Hymenocaris circularis n. sp., *H. obliqua* n. sp., *H. ovalis* n. sp., *H. parva* n. sp., *H. perfecta* n. sp., *H. vermicauda.*

Trilobita: *Neolenus serratus* Rominger. *Ptychoparia cordillerae* Rominger. *Marrella* n. gen., *M. spendens* n. sp.

WALCOTT (Charles D.)—Continued

Merostomata: *Sidneyia inexpectans* Walc.

Habelia n. gen., *H. optata* n. sp. Emeraldella n. gen., *E. brocki* n. sp., *E. micrura* n. sp. Molaria n. gen., *M. spinifera* n. sp.

Family undetermined. Nathorstia n. gen., *N. transitans* n. sp.

The specific name transitans to this species was given on account of its suggesting a transition between Merostone-like form, such as Molaria spinifera and the trilobites.

Class Crustacea: Order Anostraca—Calman Opabinidae, new family. Opabinia n. gen., *O. regalis* n. sp., *O. media* n. sp. *Leanchoilia* n. gen., *L. superlata* n. sp. Yohoia n. gen., *Y. tenuis* n. sp., *Y. plena* n. sp. Bidentia n. gen., *B. difficilis* n. sp.

Order Notostraca—Calman Naraoidae n. fam. Naraoia n. gen., *N. compacta* n. sp. Burgessidae new fam. Burgessia n. gen., *B. bella* n. sp.

Genus Anomalocaris Whiteaves, *A. gigantea* n. sp.

Waptidae: Waptia n. gen., *W. fieldensis* n. sp.

Hurdia n. gen. *H. victoria* n. sp., *H. triangulata* n. sp.

Tuzoia n. gen., *T. retifera* n. sp.

Odaraia n. gen., *O. alata* n. sp. *Fieldia* n. gen., *F. lanceolata* n. sp.

Carnarvonia n. gen., *C. venosa* n. sp.

Mollisonia n. gen., *M. symmetrica* n. sp., *M. gracilis* n. sp., *M. rara* n. sp.

Tontoia n. gen., *T. kwaguntensis* n. sp.

——— Cambrian Geology and Palæontology—2, No. 8. The Sardinian Cambrian genus Olenopsis in America.

Smithsonian Misc. Coll., vol. 57, No. 8, 1912, with plate 36.

The author describes and figures *Olenopsis zoppii* Meneghini, *O. agnesensis* n. sp., *O. americanus* n. sp., *O. roddyi* n. sp.

Dr. Bornemann distinguishes Olenopsis from Olenus, on account of its having a small, rounded tail shield, with unsegmented axis; by the particularly semicircular outline of the cephalon; the conic, nearly smooth, glabella, and 14 or 15 body segments.

——— Cambrian Geology and Palæontology—2, No. 9. New York Potsdam, Hoyt Fauna, with plates 37-49.

Smithsonian Misc. Collection, vol. 57, No. 9, 1912.

Crustacea:

Ptychoparia minuta Bradley, *P. matheri* n. sp. *Conocephalina whitehallensis* n. sp. *Pagodia seelyi* n. sp. *Agraulos saratogensis* Walc. This species was described as *Bathyurus armatus* Billings (Walcott, 32 Ann. Rep. N. Y. State Mus., p. 131) and as *Ptychoparia (A.) saratogensis* Walcott (Bull. No. 30, U. S. Geol. Sur., p. 21). *Lonchocephalus calcifernus* Walcott, previously described under the genus Conocephalites and Ptychoparia.

The species is closely related to *Lonchocephalus wisconsensis* Owen. It differs in having a relatively shorter frontal limb and longer palpebral lobes.

Ptychaspis speciosus Walcott.

Dicellocephalus Hartti Walcott. This was the *Conocephalites hartti* Walc. (32 Ann. Rep. N. Y. State Mus., p. 130).

The species differs from *Dicellocephalus minnesotensis* in details, but it appears to come within the limits of the genus.

Dicellocephalus tribulis n. sp. allied to *D. misa* Hall.

The author also describes and illustrates several tracks of crustaceans under Owen's gen. Protichnites. The author remarks that the particular trilobite that left tracks on the beaches of Potsdam sandstone time were undoubtedly species of the genus Dicellocephalus.

WALCOTT (Charles D.)—Continued

The author does not consider Climactichnites as the trail of a trilobite.

He describes *Protichnites septemnotatus* Owen and *P. Logananus* Marsh.

The author remarks that many of the impressions made by Protichnites tracks were trifid, and made by a crustacean having legs terminating in a joint that had three strong, narrow terminal spines.

On plate 45, the author illustrates *Neolenus serratus* from Burgess Pass, in which figure 4 shows the trifid arrangement of the short, strong spines of the terminal joint of the cephalic legs.

——— Cambrian Geology and Palaeontology—2, No. 11. New Lower Cambrian subfauna.

Smithsonian Misc. Coll., vol. 57, No. 11, 1913.

The author describes from Robson Peak District the following new species of Crustacea:

Holmia macer n. sp. The species resembles *Holmia Kjerulfi,* but differs in details of the head and thorax.

Wanneria occidens n. sp. The species differs from *Olenellus Gilberti* in its small, short, palpebral lobe and strong marginal rim; also in the presence of an occipital spine.

Callavia eucharis n. sp. The species has 23 segments in the thorax.

Callavia perfecta n. sp. This species has 17 thoracic segments. It differs from *C. crosbyi* in having a more tapering glabella, smaller palpebral lobes, and in the absence of a strong occipital spine.

Olenellus Truemani n. sp. This species differs from *O. Thompsoni* in having shorter palpebral lobes and eyes, and smaller and shorter plural lobes of the third thoracic segment.

——— The Cambrian faunas of China.

Carnegie Inst., vol. 3, Aug. 1, 1913, 375 pp. and 29 plates.

The Trilobites are described and illustrated on pp. 99-228, pls. 1-24. Genus Agnostus Brongniart.

Agnostus chinensis Dames, very much like *Agnostus Pic Aoraghi,* 1902, p. 5, pl. 1, f. 28. *A. douvillei* Bergeron. The author places *A. koerferi* Monke, 1903, as a syn., *A. kushanensis* Walcott, *A. parvifrons latelimbatus* Lorenz, *A.* sp. undt.

Genus Microdiscus Emmons.

Microdiscus orientalis Walcott. The author remarks that the head and the occipital spine are much like those of *M. convexus* Walc. The transverse furrow of the glabella recall those of *M. speciosus* Ford.

Genus Redlichia Cossmann, 1902, to replace Hoeferia Redlich, 1901.

The author places the *Olenellus Forresti* Foord, Geol. Mag., Dec. 3, vol. 7, 1890, p. 99, pl. 4, figs. 2, 2a-b, under this genus.

Redlichia chinensis Walcott, differs slightly from the type. *R. noetlingi,* Redlich, 1901.

R. finalis Walcott, *R. nobilis* Walc., *R.* sp. undt. three species.

Genus Albertella Walcott, 1908.

Albertella pacifica Walcott.

The author compares the pygidium of this species with *A. bosworthi* Walc. and *Paradoxides desideratus* Barrande.

The genus Dorypyge Dames, 1883.

The author does not include Olenoides Walc., under the genus Dorypyge, remarking that it differs in the glabella expanding toward the front, while that of Dorypyge

WALCOTT (Charles D.)—Continued

contracts in front of the pits in the dorsal furrow; also that the pleural lobes of the pygidium of Olenoides have broad, shallow furrows, with sharp, narrow ridges separating them; while those of Dorypyge have narrow furrows, with broad, rounded ridges between them. Type *D. richthofeni Dames,* 1883.

Dorypyge bispinosa Walc., *D. richthofeni* Dames, *D. richthofeni laevis* Walc.

Genus Teinistion Monk, 1903.

The genus is characterized by the peculiar glabella, narrow frontal margin and spinose pygidium. Type *T. lansi* Monke.

Teinistion alcon Walc., *T. lansi* Monke, *T. sodeni* Monke, *T. typicalis* Walcott, described under the genus Dorypygella by Walcott, 1905.

Genus Stephanocare Monke, 1903, syn. Damesella Chione Walcott, 1905.

Stephanocare Monkei Walcott, *S. richthofeni* Monke, syn., *D. chione* Walc., *S. sinensis* Bergeron, *S.* sp. undt.

Genus Blackwelderia Walcott, 1906.

The genus differs from Teinistion in the character of the associated free cheeks and pygidia, and the frontal limb of the cephalon; from Dorypyge in the form of the glabella and free cheeks. The thoracic segments are alike in the two genera, and the pygidia are of the same type.

Blackwelderia alastor Walc., described under Dorypygella in 1905, *B. cilix* Walc., described under Olenoides ? in 1905, *B. sinensis* Bergeron described under Calymmene ? in 1899.

Genus Damesella Walcott, 1905. Type *D. blackwelderi* Walc.

The author remarks that in Damesella and Stephanocare the facial suture cuts the posterior lateral margin outside of the genal angle, so as to leave the genal angle on the fixed cheeks, and at the same time the spine, corresponding to the genal spine in other genera of the order Proparia, on the free cheek, so Beecher's classification should be modified in relation to the exceptions made in these genera.

Damesella bellagranulata Walc., *D. blackwelderi* Walc., *D. brevicaudata* Walc., *D.* sp. undt.

Genus Drepanura Bergeron, 1899, Genotype *D. premesnili* Berg.

Drepanura ketteleri Monke, *D. premesnili* Bergeron. *Ptychoparia* Corda, 1847.

In this memoir the genus is restricted to species having the characteristic of *Ptychoparia striata* Emmrich.

Ptychoparia axlis Walc., *P. granosa* Walc., *P. impar* Walc. and var., *P. kochibei* Walc., *P. ligea* Walc., *P. lilia* Walc., *P. tolus, P. typus* Dames.

Subgenus Ptychoparia (Emmrichella) Walcott, 1911.

Genotype *Ptychoparia theano* Walc.

The subgenus differs from the following genera:

1. Ptychoparia in its smooth glabella and larger palpebral lobe.

2. Liostracus in having an arched or nearly flat frontal limb and rim and more convex cranidium.

3. Conokephalina in its smoother glabella and wider fixed cheeks.

4. Anomocare in its smoother glabella and distinct palpebral ridge, and proportionately shorter eye-lobes and glabella.

The author described under this subgenus the following species:

Ptychoparia (Emmerichella) bromus Walc., *P. (E.) constricta* Walc., *P. (E.) eriopia* Walc., *P. (E.) mantoensis, P. (E.) theano* Walcott.

Genus Liostracus Angelin, 1854. Genotype *L. aculeatus.*

Two species which the author classes under the subgenus Emmrichella—*mantoensis* and *constricta*—approach most nearly to the genus Liostracus.

Genus Conokephalina Brögger, 1886. Genotype *C. ornatus* Brögger, 1877.

WALCOTT (Charles D.)—Continued

The genus occupies an intermediate position between Dikelocephalus and Ptychoparia, characterized by its elongated palpebral lobes, narrow free cheeks and elongated glabella, narrowing more or less slightly towards the broadly rounded front.

The Chinese species are: *Conokephalina vesta* Walc., *C. helus* Walc., *C. dryope* Walc., *C. maia* Walc. and *C.* sp. undt.

Genus Crepicephalus, Owen, 1852. Genotype *C. Iowensis* Owen.

Crepicephalus damia Walc. This species, which is nearly related to *C. Iowensis*, differs by the form of the frontal limb and rim of the glabella and other details.

C. convexus Walc. and *C. magnus* Walc.

Genus Lonchocephalus Owen, 1852. Genotype *L. hamulus* Owen.

The author refers the *Ptychoparia tellus* Walc., 1905, to this genus.

Genus Liostracina Monke, 1903. Genotype *L. krausei* Monke.

Genus Proampyx Frech, 1902. Genotype *Anomocare acuminatum* Ang.

Walcott remarks that Dr. Frech appears to have overlooked the fact that the spine of the genus Ampyx is a spinose extension of the front of the glabella, while the nasute projection of the frontal rim of *Anomocare acuminatum* is from an entirely different division of the head.

Proampyx burea Walc.

Genus Pterocephalus Roemer, 1852. Genotype *P. sancti-sabae* Roemer.

The author describes *Pterocephalus asiaticus* Walc., *P. busiris* Walc. and *P. liches* all from fragments of the head and tails.

Genus Shantungia Walcott, 1905. Genotype *S. spinifera* Walc.

The genus is characterized by the large palpebral lobes, nearly smooth truncato-conical glabella, and the long, spinose extension of the front, which is unlike that of Ampyx, as the latter proceeds from the glabella; while the spine of Shantungia is from the frontal rim, in the same manner as that of *Proampyx acuminatum* Ang., but differs in the character of the glabella and palpebral lobes.

The only species described is that of the type.

Genus Inouyia Walcott, 1911.

The species referred to this genus have a swollen, tumid frontal limb; small palpebral lobes; a convex subrectangular glabella; strong dorsal furrows about the glabella, and marked glabellar furrows.

Genotype *Agraulos Capax* Walc., 1906. In addition to the type the author describes *Inouyia aharis* Walc., *I. ? acalle* Walc., *I. ? armata* Walc., *I. divi* Walc., *I. ? inflata* Walc., *I. melie* Walc., *I. ? regularis* Walc., *I. thisbe* Walc. and *I. titiana.*

Genus Agraulos Corda, 1847.

The author refigures the type of the genus and describes the following:

Agraulos abrota Walc., *A. dirce* Walc., *A. dolon* Walc., *A. dryas* Walc., *A. nitida* Walc., *A. obscura* Walc., *A. sorge* Walc., *A. uta* Walc. and *A. vicina* Walc.

Genus Pagodia Walcott, 1905. Genotype *P. lotos* Walc.

The author remarks that the genus differs from Dolichometopus and from the type in the narrowing instead of widening of the glabella in front, in the presence of small instead of large eye-lobes, short instead of long postero-lateral limbs and obscure glabella furrows.

The species referred to this genus are *Pagodia bia, P. dolon, P. lotos* and *P. macedo* Walcott.

Genus Lisania Walcott, 1911. Genotype Anomocarella ? bura Walc.

The species referred to the genus are all small, represented by cranidia and associated free cheeks and pygidia.

Lisania agonius Walc., *L. ajax* Walc., *L. alala* Walc., *L. belemus, L. bura* Walc. and *L.* cf. *bura* Walc.

WALCOTT (Charles D.)—Continued

Genus Solenopleura Angelin, 1854.

Walcott figures pl. 17, figs. 12, *Solenopleura holometopa* Angelin for comparison, and describes as new the following species:

Solenopleura agno Walc., *S. heroe* Walc., *S. chalcon* Walc., *S. intermedia* Walc., *S. pauperata* Walc., *S.* sp. undt.

Genus Chuangia Walcott, 1911. Genotype *Ptychoparia batia* Walc.

The genus proposed for a group of Upper Cambrian Trilobites in which the cephalon has a truncato-conical or subquadrangular glabella; a narrow concave frontal limb and smooth test.

Three species are described: *Chuangia nitida, C. mais* and *C. framenta.*

Genus Menocephalus Owen, 1852.

Doctor Owen proposed this genus for Trilobites having a highly convex hemispherical glabella, with a narrow border and broadly rounded front cheeks, tumid surface pustulate.

The genotype of Menocephalus was destroyed by fire many years ago.

Dr. Walcott does not include in the genus the species described by Billings under the names of *Menocephalus sedgwicki* and *M. globosus,* which he refers to Solenopleura, and remarks that *M. salteri* Devine, is the type of an undescribed genus.

The author describes *Menocephalus abderus,* the *Solenopleura abderus* Walc., 1905, *M. acanthus* Walc. *(Solenopleura acantha* Walc. 1905), *M. acerius* Walc., *M. acidalia (Solenopleura acidalia* Walc., 1905), *M. acis* Walc. and *M. admeta* Walc., *M. agave* Walc., *M. depressus* Walc., *M.* sp. undt.

Genus Levisia Walcott. Genotype *Agraulos agenor* Walc.

In this genus the cranidium is strongly convex, glabella truncato-conical, tumid and with only a trace of glabella furrows; occipital ring narrow, at the sides broadening rapidly toward the center, convex and extending backward into an obtuse spine; frontal limb narrow; fixed cheeks tumid, one-half as wide as the glabella and with small palpebral lobes midway of their length; postero-lateral limbs rather short and marked by deep, narrow intermarginal posterior furrow, that separates a narrow, rounded margin. The author describes *Levisia adrastia* Walc. (under the genus of Menocephalus Walc., 1905), *Levisia agenor* Walc. under the genus Agraulos Walc., 1905) and *Levisia nasuta* Walc., *Levisia richardsoni* Walc. The last two species are from the Upper Cambrian at Point Levis, Canada.

Genus Ptychaspis Hall, 1863. Genotype *Dikelocephalus miniscoensis* Owen.

The author describes from China, *Ptychaspis baubo* Walc., *P. bella* Walc., *P. brizo* Walc., *P. causu* Walc., *P. cadmus* Walc., *P. calchas* Walc., *P. callisto* Walc., *P. calyce* Walc., *P. campo, P. ceto* Walc. and *P.* sp. undt. Walc.

Genus Anomocare Angelin, 1854. Genotype *A. laeve* Ang.

The author describes fourteen species under this genus, all new except three species, which he refers to Dames.

Anomocare alcinoe, A. convexa, A. daulis, A. ephori, A. flava, A. latelimbatum Dames, *A. lisani, A. megalurus* Dames, described under the genus Liostracus; *Anomocare minus* Dames, *A. nereis* Walc., described in 1906 under the genus Ptychoparia, *A. subquadratum* Dames *(Concephalus subquadratus* Dames), and Anomocare sp. undt. several forms.

Genus Anomocarella Walcott, 1905. Genotype *A. chinensis* Walcott.

This genus differs from Anomocare in the absence of glabella furrows and the presence of a relatively narrow flattened frontal rim, etc.

The author places twenty-two species under this genus.

Anomocarella albion, A. baucis, A. bergioni, A. bigsbyi, A. biston, A. butes, A. chinensis, A. comus (Ptychoparia comus Walc., 1906), *A. hermias, A. irma, A. macar,*

WALCOTT (Charles D.)—Continued

A. smithi, A. speciosa Lorenz (described by Lorenz under the genus Anomocare). Anomocarella *subrugosa* Walc. *(Ptychoparia (Liostracus) subrugosa* Walc., 1906).

Anomocarella tatian Walc., *A. temenus* Walc., *A. tenes* Walc. *(Ptychoparia tenes* Walc., 1905), *A. thraso* Walc., *A. toxes,* Walc., *A. tutia, A. undata* Walc.

The last five species were described by Walcott in 1905, and six under the genus Ptychoparia.

Genus Cossia Walcott, 1911. Genotype *C. superba* Walc.

The author refers to his type for the generic description, and includes five species under the genus.

Coosia bianos, C. carme, C. daunus, C. decelus.

All previously described in 1905 under Anomocare, except *Coosia carme,* which was originally included under Anomocarella.

Coosia robusta and *C. superba* Walcott.

Genus Dolichometopus Angelin, 1854. Genotype *D. svecicus* Ang.

Walcott places Amphoton Lorenz, 1906, as a syn.

The author describes five species from China.

Dolichometopus alceste Walc., *D. deois* Walc., syn. *Bathyriscus asiaticus* Lorenz and *Amphoton steinmanni* Lorenz, *D. derceto* Walc., *D. dirce* Walc., *D. hyrie* Walc.

Genus Hysterolenus Moberg, 1898.

The author only includes one species, Hysterolenus ? sp. undt.

Genus Bathyuriscus Meek, 1873.

Bathyuriscus manchuriensis Walc.

Genus Asaphiscus Meek, 1873.

Asaphiscus iddingi Walc.

Genus Illaenurus Hall, 1863.

Illaenurus canens Walc., *I. ceres, I. dictys* Walc.

Ostracoda:

Genus Aluta Matthew.

The author includes under this genus six species previously described under the genus Bradoria.

Aluta bergeroni Walc., *A. enyo* Walc., *A. eris* Walc., *A. fragilis* Walc., *A. sterope* Walc., *A. woodi* Walc.

Merostoma.

Genus Amiella Walcott, 1911.

Amiella yunnanensis Mansuy (MSS.)

— Cambrian Geology and Palæontology—2, No. 13. Dikelocephalus and other genera of the Dikelocephalinae.

Smithsonian Misc. Collections, vol. 57, No. 13, 1914.

The author includes under the family Dikelocephalina Beecher, 1897, the following genera:

Dikelocephalus Owen, 1852.

Referring to the restricted genus the following species:

Dikelocephalus minnesotensis Owen, and a variation *D. dalyi* n. sp. The palpebral lobe of *D. dalyi* is shorter than in typical Dikelocephalus, in this respect, resembling some species of Anomocare, but not the typical species *Anomocare laeve* Angelin, *D. Texanus* n. sp.

Dikelocephalus hartti Walcott. This is the *Conocephalutes hartti* Walc., 1879.

D. limbatus Hall, *D. tribulis* Walc., 1912, and *D. vanhornei* n. sp. The cranidium is much like the genotype, but it has a shorter glabella and wider fixed cheeks.

2. Conokephalina Brögger, 1886, genotype *C. ornatus* Brögger.

WALCOTT (Charles D.)—Continued

Walcott refers *Dikelocephalus misa* Hall to this genus. The other species referred by Brögger to the genus, such as *Dikelocephalus osceola* Hall, are referred by Walcott to a new genus Osceolia, and *Dikelocephalus spiniger* to the new genus Calvinella.

3. Saukia, new genus. The genus has a narrow frontal border about the cephalon, and a glabella proportionately more elongated than in Dikelocephalus. The pygidium is less expanded and more elongate than that of Dikelocephalus. Genotype *Dikelocephalus lodensis* Whitf.

The author describes *Saukia coloradoensis* n. sp., *S. crassimarginata* Whitfield, 1882, *S. fallax* n. sp., *junia* n. sp., *S. leptaenarum* Wiman, 1907; *S. leucosia* n. sp., *S. lodensis* Whitf. the type *S. marica* Walc., 1886; *S. pepinensis* Owen, 1852; *S. pyrene* n. sp., *S. rustica* n. sp., *S. stosei* n. sp., *S. wardi* n. sp.

4. Osceolia, new genus. This genus is characterized by its concave frontal limb, palpebral lobes, narrow fixed cheeks and transverse pygidium with its anterior segment extended beyond the margin as a long spine. Genotype *Dikelocephalus oseola* Hall, 1863.

5. Calvinella, new genus. Genotype *Dikelocephalus spiniger* Hall, 1863. This genus is like Saukia, but differs in form of the glabella, presence of strong occipital spine, and proportionally more elongated pygidium. It differs from Osceola in frontal limb of cephalon, presence of occipital spine and character of pygidium.

The author refers to the genus *Dikelocephalus newtonensis* Weller, 1903; *Calvinella ozarkensis* n. sp. *Dikelocephalus spiniger* Hall, 1863, and *Calvinella tenuisculpta* n. sp.

——— Cambrian Geology and Palæontology, Part 3, No. 1. The Cambrian faunas of Eastern Asia.

Smithsonian Misc. Coll., vol. 64, No. 1, 1914.

The author gives a historical review with a summary of the genera and species.

A new genus, Tsinania, with *Illaenurus canen* for the genotype, is given on page 43. The genus differs from Illaenurus Hall, in having the cranidium rounded in front, by the incurving of the facial sutures, and short postero-lateral limbs. He refers several species to the new genus previously included under Hall's genus, viz: *Tsinania canens, T. ceras, T. cleora* and *T. dictys.*

— — Cambrian Geology and Palæontology, No. 3. Cambrian Trilobites.

Smithsonian Misc. Coll., vol. 64, No. 3, 1916.

The author, under the Order Proparia, describes several new genera.

Family Menomonidae—Menomonia a new genus with *Conocephalites, calymenoides* Whitfield as the genotype.

Millardia, a new genus with *M. semele* as genotype. Refers one new species *M. avitas* and *Conocephalites optata* Hall, also, to the genus.

Dresbachia, a new genus with *D. anata* as the genotype.

Norwoodidæ, a new family with a new genus, Norwoodia, with five new species: Genotype *N. gracilis,* also *N. ponderosa, N. Saffordi, N. simplex* and *N. tenera.*

The cranidium, with its Ptychoparia-like glabella and small eyes and broad pleural furrows, are primitive, while the few thoracic segments (8 or 9) and relatively large tail, suggests the sub-family Phacopinae. Under the order Opisthoparia, he describes *Agraulos stator* n. sp.; also Acrocephalites Wallerus, with a translation of that author's description of the genus, with nine new species. Refers *Solenopleura ? stenometopa* Ang. and *Conocephalites vulcanus* Bill. to the genus.

Compares the new species *A. Haynesi* and *tutus* with the genotype, *Acrocephalites insignis* has narrower fixed cheek and frontal limb of *A. stenometopus, A. Americanus*

WALCOTT (Charles D.)—Continued

is a larger species than the genotype. *A. aster* has a frontal boss much like the type. *Acrocephalites multisegmentus* has 25 thoracic segments. *A. aoris*, a species much like *A. tutus;* also *A. glomeratus*, a species like *A. ? majus.*

The author describes seven species under Lorenz's genus Alokistocare, of which *A. althea, A. ? labrosun, A. pomona* and *A. ticida* are new. He refers *Ptychoparia ? Linnarssoni* and *P. ? prospectense* to the genus, and includes a figure and description of the genotype *Conocephilites subcornatus* Hall and Whitfield, which he compares with the new species *A. althea.*

The author includes under the genus Lonchocephalus eight species, five of which are described as new: *Lonchocephalus appalachia, L. bunus, L. pholus, L. plena, L. sospita.*

Describes and illustrates the genotype *L. Chippewaensis* Owen. Refers Shumard's *Conocephalites minor* and *C. minutus* Bradley to the genus.

Dr. Owen, plate 1-A, fig. 15, Geol. Sur. Wis., Iowa and Minnesota, 1852, p. 624, refers to Lonchocephalus ? a pygidium with lateral spines, similar to *Dikelocephalus Iowensis*, which Walcott places as the genotype of Crepicephalus.

The author remarks that Lonchocephalus is most nearly related to Liostracus Angelin, with only the cranidium for comparison. The difference between them is in the frontal limb and rim, and the absence of well-defined glabella furrows in Liostracus.

The author uses the *Conocephalites calciferous* for the genotype of a new genus Saratogia, placing under it six species, four new: *S. arses, S. aruno, S. hera* and *S. volux*, with *Crepicephalus Wisconsensis* Owen; including as syn. *Dikelocephalus latifrons*, described by Hall, also by Shumard, under this genus.

In the family Ceratopygidae, genus Crepicephalus Walcott (not Owen), the author includes some 20 species.

Walcott uses *Dikelocephalus ? Iowensis* Owen, for the genotype.

Owen's genus, as the name implies, was for a slipper-shaped, tapering glabella, a true Ptychoparia species, which Corda named in 1847. Dr. Owen used the term Dikelocephalus for the mattock-shaped heads, and refers to Dikelocephalus such species as Walcott genotype, although Owen referred to Lonchocephalus, a form like *Crepicephalus Iowensis* Walcott, on p. 624, pl. 1-A, fig. 15.

Lonchocephalus might replace in part Anomocare, and Crepicephalus be referred to Lonchocephalus for Owen's Lonchocephalus, p. 624, pl. 1-A, fig. 15.

Walcott divides the pygidae into two groups:

1. The *Crepicephalus Iowenis* group.

In which the postero-lateral margins of the pygidium extend backward on each side from a broad base into a sharp, narrow spine. Test nearly smooth. Upper Cambrian.

2. *Crepicephalus Texanus* group.

In which the postero-lateral spines are long, slender, and attached to the side of the pleural lobe above the margin. Test granulated. Lower Cambrian.

The author describes and figures *Crepicephalus angusta, C. camiro, C. comus, C. cossensis, C. coria, C. dis, C. Iowensis* (Owen) *A. Liliana, C. Texanus* (Shumard) var. *danace* and *elongatus, C. thoosa, C. tripunctatus* (Whitfield) also var. *magnispinus, C. tumidus, C. unca, C. unzia, C. upis*, and two doubtful species.

Under the Family Oryctocephalidae, the author includes the new genus Vanuxemella. This genus, represented by *V. contracta* and *V. nortia*, from the Lower Cambrian, has a simple form, with some features suggesting Albertella. It differs in absence of glabellar furrows, shorter eye lobes, absence of prolonged third segment of thorax, with only four thoracic segments. The long spines of the tail spring from about the fifth segment, while in Albertella they appear to be the extension of the first or second anterior segment.

Walcott includes under his genus Karlia the genotype *K. minor* and *Menocephalus*

WALCOTT (Charles D.)—Continued

Salteri ? Rominger, which he refers to *Karlia Stephensis.* Dr. Matthew, 1899, refers the genus to Dorypyge, and the species to *Dorypyge Dawsoni.*

The author describes a new genus Hanburia with its genotype *H. gloriosa.* Remarks the large pygidium and few thoracic segments suggest the order Opisthoparia and family Asaphidae. From Burgess Pass above Field, B. C.

Under Tsinania, the *Illaenurus canens* Walc., as the genotype, Walcott, includes the new species *T. cleora* and *T. elongata.*

Plate 38 gives figures of *Wanneri Walcottana,* figs. 1 and 2.

——— Cambrian Geology and Palæontology—3, No. 5. Cambrian Trilobites.

Smithsonian Misc. Collections, vol. 64, No. 4, pp. 303-456, plates 45-67, 1916.

The author describes and illustrates the following Cambrian Trilobites:

Corynexochus bornholmiensis Grönwall, *C. brennus* Walc., *C. bubaris* Walc., *C. capito* Walc., *C. clavatus* Walc., *C. delagei* Miquel., *C. minor, C. senectus* (Billings), *C. spinulosus* Ang., *C. stephenensis* (Walc.).

Refers *Corynexochus romingeri* Matt. to *C. stephensis, Corynexochus ? umbonatus* Angelin to the genus Æglina.

The new subgenus Bonnia is proposed as a subgenus to Corynexochus, with *Bathyurus parvulus* as the genotype.

The author includes *Corynexochus (Bonnia) busa* nov., *C. (Bonnia) fieldensis,* the *Protypus fieldensis* Walcot, 1908.

Corynexochus (Bonnia) parvulus the *Bathyurus parvulus* Billings, 1861.

Sub-family Dolichometopinae.

Bathyuriscus adaeus nov., *B. anax* nov.

The *Bathyuriscus productus* (H. & W.) Walc., in part, 1886, Bull. U. S. Geol. Sur., No. 30, pl. 30, fig. 1, 1a, 1b, 1g and 1h.

Bathyuriscus atossa nov., *B. bantius* nov., *B. batis* nov., *B. belesis* nov., *B. belus* nov., *B. ? bithus* nov., *B. Haydeni* Meek, *B. Howelli* Walc., *B. Manchuriensis* Walc., *B. ornatus* Walc., *B. rotundatus* Rominger, *B. Stoliczkai* Reed, *B.* sp. undetermined, Nos. 1 and 2.

Bathyuriscus (Poliella) new subgenus.

Most of the species of Poliella are small, with from seven thoracic segments to eleven segments and a small pygidium.

The genotype *Bathyuriscus (Poliella) anteros* Walcott.

The author includes eight species under the subgenus: *Bathyuriscus (Poliella) anteros* nov., *B. (P.) powersi, B. (P.)occidentalis* nov., *B. (P.) primus, B. (P.) caranus* nov., *B. (P.) sylla, B. (P.) balus* nov., *B. (P.) probus.*

Dolichometopus.

Dr. Walcott refers eleven species to this genus: *Dolichometopus acadicus* Matt., *D. ? alceste* Walc., *D. baton* Walc., *D. ? bessus* Walc., *D. bion* Walc., *D. boccar* Walc., *D. ? deois* Walc., *D. ? derceto* Walc., *D. ? dirce* Walc., *D. ? expansus* (Walc.), *D. productus* (H. & W.), *D. suecicus* Ang., *D. tontoensis* Walc.

The other species of Dolichometopus, such as *Dolichometopus ? convexus* Billings, referred to Bolbocephalus, *D. ? gibberulus* Bill., to Platycolpus, *D. hyie* Walc., to Anomocare, *D. occidentalis* Matt. to Bathyuriscus, *D. ? rarus* Bill. to Bolbocephalus, *D. tatei* Woodw. to Redlichia.

The author forms a new subgenus, for certain species with a small palpebral lobe, that lack genal spines on the free-cheek, with *Dolichometops (Housia) varro* Walcott as the genotype.

Family Asaphidae, sub-family Ogygiocarinae.

WALCOTT (Charles D.)—Continued

Ogygopsis Klotzi (Rominger).

Orria new genus, with *Orria elegans* Walcott, as the genotype. Both Orria and Ogygopsis suggest a stage of development between Bathyuriscus and Ogygiocaris. The form is Ogygopsis-like, but differs in that the cephalon is smaller in proportion to the thorax and the pygidium; fixed cheeks nearly absent between palpebral lobes and glabella; palpebral lobes large and close to glabella; postero-lateral limbs long and narrow antro-lateral limbs; only a narrow space between the glabella and facial sutures; pleural grooves of thorax segments broad and straight, instead of narrow and diagonal.

Asaphiscus the author refers to the genus.

Asaphiscus calenus Walc., *A. camma* Walc., *A. ? capella* Walc., *A. ? granulatus* Walc., *A. Iddingsi* Walc., *A. ? minor* Walc., *A. ? unispinus* Walc., *A. Wheeleri* Meek, the genotype; also *A. agatho* Walc., *A ? anaxis* Walc., *A. calanus* Walc., *A. ? duris* Walc., with three sp. undt., and *A. ? florus* nov.

Blainia new subgenus.

The species referred to Blainia have nine thoracic segments and from six to eleven distinct anchylosed segments in the pygidium. Genotype *Asaphiscus (Blainia) gregarius* Walc.

Dr. Walcott includes four new species under the subgenus:

Asaphiscus (Blainia) elongatus, A. (B.) glabra, A. (B.) paula.

Blountia new genus.

The author refers seven species to this genus. Genotype *Blountia minula* Walc., *Blountia ? alemon* Walc., *B. alethes* Walc., *B. alexas* Walc., *B. amage* Walc., *B. andreas* Walc., *B. anser* Walc., and *B. mimula* from the Upper Cambrian.

Maryvillia new genus. Genotype *M. Arion* and *M. Ariston* nov.

The pygidia associated with the cranidae of these species are elongate, with about fourteen segments, which suggest transition from Blountia to Tsinania, as represented by such species as *Tsinania canens* Walc., etc.

Family Olenidae: Marjumia new genus. Genotype *M. typa* Walc.

This genus appears to unite characters found in several genera. The cephalon is essentially that of Asaphicus, the thorax that of Ptychoparia, and the pygidium that of *Peltura scarabaoides* and *Paraholina megalops.*

In addition to the type the author describes *Marjumia callas* nov. Lisania Walc. genotype *Anomocarella bura* Walc. and *L. ? breviloba* nov.

Illaenurus quadratus Hall.

Mesonacis Gilberti Meek.

Proparia, Family Eodiscidae: Pageti new genus. Genotype *P. bootes* Walc. The new genus was proposed for the forms of Eodiscidae, in which the eye, the free cheeks and facial sutures are developed. Two species described *Pagetia bootes* and *P. clytia.*

— — Cambrian Geology and Palaeontology IV, No. 2. The Albertella fauna in British Columbia and Montana.

Smithsonian Misc. Coll., vol. 67, No. 2, 1917, May 9, 1917.

The author describes from this formation the following Crustacae:

Agraulus stator Walc.

Ptychoparia candance nov.

The elongated body and small pygidium suggest *Agraulos stator,* but the cranidium is that of Ptychoparia, and there are 16 thorax segments, while *A. stator* has 22, a middle Cambrian form.

Ptychoparia ? charax nov.

This species is probably a subgenus with a Ptychoparia-like cranidia, with a broad concave frontal border and rim, that will undoubtedly be placed in a subgenus.

WALCOTT (Charles D.)—Continued

Ptychoparia ? cilles nov. *P. pylas* nov., from Gordon Creek, Montana.

Crepicephalus chares nov., related to *C. camiro.*

Vanuxemella nortia Walc. *Olenopsis* cf. *Americanus* Walc.

Albertella Bosworthi Walc., *A. Helena* Walc., *A. levis* nov.

Zacanthoides charilla nov. compares *Z. idahoensis Z. ? cimon* nov., *Z. cnopus* nov., the thorax has the great median spine on the 8th segment instead of the 5th as in *Z. Idahoensis.*

Neolenus constans nov.

Bathyuriscus Rossensis nov., characterized by the very much produced genal spines extending backwards to the pygidium.

Bathyuriscus cf. *Rossensis* nov. The glabella is longer and more slender proportionally than that of *Rossensis.*
but differs in many details.

Bathyuriscus (Poliella) chilo nov.

Differs from *B. (P.) sylla* of the Chetang formation in the nearly straight sides of the glabella, and narrower and shorter associated pygidium. Related to *B. (P.) primus,*

Wallereus (Iran D.) Undersokungen ofver zonen med *Agnostus laevigatus* 1, Vestergotland Jämte en inledande ofversikt af Vestergotlands samtliga Paradoxideslager Lund, 1895, 72 pp., plate.

Agnostus laevigatus Dalm. also var. *armata* Linrs., *A. exsculptus* Ang., also forma *sulcifera, integra, Agnostus planicauda* Ang.; also forma *vestgothica, A. pisiformis* Linné *A. fallax* Linrs. forma *ferox* Tulb. and var. *insignis* n. var.

Conocephalus suecicus n. sp.

Acrocephalites stenometopus n. gen. for Angelin's *Solenopleura ? stenometopus.* It is characterized by a suture running inwards to the rim of the head shield in front of the eyes, a pointed front to this shield, and a small knob in front of the glabella.

Liostracus costatus Ang. *Proceratopyge conifrons* n. gen. et sp. This genus, as its name indicates, is the typical species of the Ceratopyge. It differs in its conical glabella, its four pairs of glabella furrows and the triangular front fold of the rim.

Toxotis pusilla n. gen. et sp. This is a remarkable genus, which retains several embryonic or early larval characters, as the narrow glabella, and three swellings on the front of the shield.

Paradoxides sp. *Leperditia primordalis* Linrs. This paper was reviewed by G. F. Matthew, Amer. Geol., vol. 17, 1896, pp. 49-50.

Walther (Karl). Das Unterdevon zwischen Marburg a L. und Herborn Nassau.

Neues Jahrb. Mineralogie, Beil, vol. 17, 1903, pp. 1-75, 4 plates.

Cryphaeus laciniatus F. R., *C. Lethaeae* Kays. *Cryphaeus* sp. *Homalonotus armatus* Burm., *H. gigas* A. Roem., *H. crassicauda* Sandb. *Homalonotus* sp. *Lichas* cf. *Haueri* Barr. *Phacops* sp.

Ostracoda: *Beyrichia strictisulcata* (Sand.) Jones. *Bollia varians* (Sand.) Jones.

— Beitrage zur Geology and Palæont des älteren Paläoz in Ostthuringen.

Neues Jahrb. für Mineral, etc., 1907, Bd. XXIV.

Ward (J.) Contributions to the geology and palæontology of North Staffordshire, No. vi. Palæontology of the Cheadle Coalfield.

Stone Rep. N. Staff, F. Cl. 40, 1906, pp. 102-137, pl. 2.

Wanner (Arteus). A new species of Olenellus from the Lower Cambrian of York County, Penn.

Proc. Washington Acad. Sci., vol. 3, 1901, pp. 276-272, plate.

Olenellus (Holmia) Walcottanus n. sp.

Dr. Walcott refers this to his new genus Wanneria.

Wenjukow (P. N.) Die Fauna der Silurischen Ablagerungen des Gouvernments Podolien.

Mater. Geol. Russ, vol. 19, 1899, pp. 21-266, plates 1-9.

Trilobita: *Encrinurus punctatus* Brunn., *E. ? obtusus* Ang. *Sphaerexochus mirus* Beyr. *Illaenus (Bumastus) barriensis* Murch., *I. Bouchardi* Barr. *Calymmene tuberculata* Brunn. *Phacops (Acaste) Downingiae* Murch., *P. (Odontochile) caudatus* Brunn. *Proetus concinnus* Dalm. *Eurypterus Fischeri* Eichw.

Ostracoda: *Leperditia tyraica* Schm. *Beyrichia inornata* Alth., *B. idonea* n. sp., *B. Buchiana* Jones, *B. inclinata* n. sp., *B. Reussi* Alth. *Entomis reinformis* n. sp. *Primitia concinina* Jones.

Weller (Stuart). Descriptions of the Cambrian Trilobites from New Jersey, with notes on the age of the Magnesian Limestone series.

Ann. Report Geol. New Jersey for 1899, pp. 47-53, plate.

The species described are *Olenellus Thompsoni* Hall. *Liostracus ? jerseyensis* n. sp. Referred to Solenopleura by the author in Palæontology New Jersey, vol. 3, p. 119.

——— Report on the Palæontology of New Jersey.

Geol. Sur. New Jersey, vol. 3, Trenton, 1903, 388 pp., 23 plates.

Cambrian Fauna: Olenellus Thompsoni Hall, *O.* sp. undet.

Ptychoparia Blairi n. sp., *P. Newtonensis* n. sp., *P. calcifera* Walc., *P.* sp. undet. *Agraulos saratogensis* Walc. *Solenopleura jerseyensis* n. sp. *Anomocare parvula* n. sp. *Dikelocephalus newtonensis* n. sp. Referred by Walcott to Calvinella.

Ordovician Fauna: *Asaphus canalis* Whitf. Referred to *Asaphella gryracanthus* by Raymond. *Illaenurus columbiana* n. sp. Referred to *Symphysurus convexus Bathyurus* sp. undet.

Trenton Fauna: *Harpina ottawensis* Bill. Referred to Eoharpes by Raymond. *Trinucleus concentricus* Eaton. *Isotelus gigas* DeKay. *Ptychoparia jerseyensis* n. sp. Referred to *Bathyurus longispinus* Walc., by Raymond. *Bumastus trentonensis* Emm. The author figures the small species described by Emmon under Illaenus, with eight thorax segments. This is taken for the type by Clarke, and described as Bumastus by Billings under the name of *Milleri*. Emmon's *Bumastus trentonensis* is a larger species; referred by Raymond to *Bumastus Billingsi*. *Bumastus tranversalis* n. sp. and *B. elongatus* n. sp. *Proetus latimarginatus* (name pre-occupied by H. & C.). *Proteus Welleri* nov., *P. brevimarginatus* n. sp. *Cyphaspis trentonensis* n. sp. *Bronteus lunatus* Bill. *Arges tuberculatus* n. sp. *Platymetopus trentonensis* Conrad. *Odontopleura parvula* Walc. *Encrinurus trentonensis* Walc. and *Calymmene senaria* Conrad. *Ceraurus pleurexanthemus* Green. *Pseudosphaerexochus trentonensis* Clarke. *Pterygometopus callicephalus* Hall, *P. intermedius* Walc.

Ostracoda: *Leperditia fabulites* Conrad, *L. ornata* n. sp. *Eurychilina oculifera* n. sp., *E. jerseyensis* n. sp.

Silurian Fauna: *Proetus pachydermatus* Barrett, *P. ? depressus* n. sp., *P. spinosa* n. sp. (a doubtful species of Proetus or Phacops). *Calymmene camerata* Conrad. *Dalmanites aspinosa* n. sp.

Ostracoda: *Leperditia altoides* n. sp. *Beyrichia sussexensis* n. sp., *B. Barretti* n. sp., *B.*

WELLER (Stuart)—Continued

perinflata n. sp., *B. jerseyensis* n. sp., *B. nearpassi* n. sp., *B. deckerensis* n. sp. *Bathocypris nearpassi* n. sp.

Devonian Fauna: *Dalmanites pleuroptyx* Green. *Proetus protuberans* Hall. *Lichas pustulosus* Hall. *Homalonotus Vanuxemi* Hall. *Phacops Logani* Hall. *Dalmanites dentatus* Barrett. *Homalonotus DeKayi* Green. *Phacops rana* Green. *Dalmanites* sp. and *D. anchiops* Green.

Leperditia alta Conrad. *Beyrichia Kummelli* n. sp., *B. wallpackensis* n. sp., *B. montaguensis* n. sp., *B. Smocki* n. sp., *B. nanliensis* n. sp. *Leperditia elongata* n. sp., *L. gigantea* n. sp. (pre-occupied for a species by Roemer).

——— The Palæontology of the Niagaran Limestone in the Chicago area—The Trilobita.

Bull. Chicago Acad. of Sciences, No. iv, part 2, 1907, pp. 163-281, plates 16-25.

The author gives classification of the Trilobita and bibliographic list of the species of North American Silurian Trilobita; also a description of the following species:

Harpes Telleri n. sp. *Illaenus insignis* Hall, *I. Harrisi* n. sp., *I. niagarensis* Whitf., *I. armatus* Hall, *I. ioxus* Hall, *I. graftonensis* M. & W., *I. transversalis* n. sp., *I. imperator* Hall, *I. cuniculus* Hall, *I. chicagoensis*, n. sp.

Illaenoides n. gen. Similar to Illaenus, but with the head more strongly trilobed, with longer and stronger dorsal furrows. The eyes are small and situated much farther forward than in Illaenus. Thorax and pygidium as in Illaenus.

Illaenoides triloba n. sp. *Proetus channahonensis* n. sp., *P. Handzwerki* n. sp. *Cyphaspis intermedia* n. sp. *Bronteus acamas* Hall.

Lichas: *Corydocephalus phlyctainodes* Green. *Dicranopeltis decipines* W. & M., *D. nasuta* n. sp., *D. Telleri* n. sp. *Metopolichas pugnax* W. &. M., *M. Ferrisi* n. sp.

Arctinurus occidentalis Hall, *A. chicagoensis* n. sp. *Acidaspis Vanhornei* n. sp. *Odontopleura illinoisensis* n. sp. *Ceratocephala goniata* Warder. *Encrinurus Egani* Miller, *E. tuberculifrons* n. sp. *Calymmene niagarensis* Hall. *Ceraurus niagarensis* Hall, *C. Hydei* n. sp. *Sphaerexochus Romingeri* Hall. *Deiphon americanus* n. sp. *Staurocephalus obsoleta* n. sp. *Phacops Handzwerki* n. sp. *Dalmanites platycaudatus* n. sp., *D. illinoisensis* n. sp., *D. vigilians* Hall, *D. arkansanus* Van Ingen, *D. verucosus* Hall.

——— Kinderhook faunal studies. The Fauna of the Fern Glen Formation.

Bull. Geol. Soc. Amer., vol. 20, pp. 265-332, pls. 10-15, 1909.

Proetus fernglenensis n. sp.

The author compares this with *Proetus missouriensis*, but that species is proportionately longer, with a glabella which is somewhat broader and subtruncate in front.

——— Descriptions of new species of Ordovician fossils from China.

Proc. U. S. Nat. Mus., vol. 32, No. 1549, 1907, pp. 557-563.

The Trilobites described are *Ampyx chinensis* n. sp. *Asaphus blackwelderi* n. sp., *A. asiaticus* n. sp., *A. taningensis* n. sp., *A. laevis* n. sp., *A. chinensis* n. sp. *Megalaspis minor* n. sp. *Illaenus bronteoides* n. sp. These species were afterwards figured in Researches in China, Carnegie Inst. of Washington, vol. 3, 1913.

——— A report on Ordovician fossils collected in Eastern Asia in 1903-04.

Research in China, vol. 3, 1913, pp. 279-294, plates 25-26.

The author describes Ampyx chinensis allied to *A. nasutus* Dalman. Ampyx sp. cf. *A. costatus* Boeck. Bathyurus sp. undt.

Asaphus blackwelderi n. sp. The Chinese species may be distinguished from *A. expanus* Dalman, on account of its obsolete glabella.

WELLER (Stuart)—Continued

Asaphus taningensis n. sp., *A.* sp. cf. *A. expansus* Dalman, *A. asiaticus, A. laevis* Weller, *A. chinensis* Weller.

The author also describes several species of the Asaphus without identification.

Megalaspis minor Weller. *Illaenus bronteoides* Weller. *Proetus* sp. undt. *Calymmene* sp. undt. *Pterygometopus* sp. undt.

The author remarks, that among the Trilobites the most conspicuous feature in the Chinese fauna is the great variety of Asaphidae belonging to the genera Asaphus, Megalaspis and Isotelus.

Westergärd (A. H.) Index to N. P. Angelin's Palæontologia Scandinavica, with notes, Lund, 1910.

Meddelande från Lund's Geologiska Fältklubb, Ser. B, No. 5.

The author remarks that the first fasciculus of the work, which is printed in quarto and written in Latin, (the copy I have bears no date. Plate 22 was not issued in this edition), but published in Fasc. 2, was issued in 1851 with pp. 1-24, and plates 1-xxiv, under the title, "Palæontologia Svecica."

Lindström's edition, 1878, states that this appeared in 1852.

The second fasciculus, containing plates xxv-xli and pp. 25-92 (or rather pp. 21-92, because the latter part of the third sheet of fasc. 1 was reprinted in essentially altered form), appeared in 1854, when the title of the work was also altered into "Palæontologia Scandinavica," for the evident reason that there are a great number of species from Norway and Bornholm cited in this fasciculus. Pages I-lx were added, containing an account of Silurian stratigraphy, and one page of "Addenda et Corrigenda," besides which plates xx and xxii were enchanged for new ones.

In 1878 the entire work was re-edited by G. Lindström, under the title of "Pars I Iconographia Crustaceorum Formationis Transitionis." In this work facs. 1 and 2 form only the first part of the projected work.

In 1855 Angelin got a public subvention for editing fasc. 3. This was not published, but several of the plates, intended for this fasc. were printed. Two of these plates, A and B, reproductions exclusively of Crustacea, have probably been appended to privately distributed copies of Palæontologia Scandinavica. Some of these plates distributed in some way are cited in literature, Grönwall Danm. Geol. Unders. II Raekke, No. 13, p. 107 (note at foot of page), quotes Table XLIII, on which *Paradoxides Davidis* Salter is reproduced under the name *Paradoxides Pingelli* Beck MS.

Before Angelin set to work writing "Palæontologia Scandinavica," he sold collections of Swedish fossils, several of which he had himself named. A list of these collections, embracing five decades, was printed under the title "N. P. Angelini Mus. Pal. suecicum, Sectio prima, Petrefacta formationis s. d. transitionis superiors centuria, I ma."

When Angelin in "Palæontologia Scandinavica" cites one of these new species he puts "nob" after the name and not new species.

The notes on pp. 12-48, contain notes and corrections to Angelin's work. Lorenz, since the issue of this Index, has referred *Solenopleura branchymetopus* Ang. to the genus to *Ptychoparia.*

These notes are supplementary to page 1, Occasional Paper iv, Cal. Acad. of Science, 1893.

In a note to the author from Dr. Sv. Leonh. Törnquist, who was a student under Angelin, he remarks, that "as to the plates XLIII-XLV of 'Palæontologia Scandinavica,' Angelin seems himself to have rejected them. Be this as it may, when after the author's death the work was re-edited by the Academy of Science, it was decided that the said plates, owing to their incorrectness, should be maculated, and all the copies were accordingly destroyed, in order to prevent their being cited. Some proof sheet may,

however, have escaped destruction since, and Angelin's memory will certainly be best served if they are not mentioned."

Whitborne (C. F.) Descriptions of the Fossils from the Morte Slates.

Quart. Jour. Geol. Soc. London, vol. 53, 1897, pp. 445-462, plate 31.

Dalmanites (Cryphaerus) laciniatus F. Rom. *Dalmanites* sp. *Homalonotus* sp.

Whiteaves (J. F.) Preliminary list of fossils from the Silurian (Upper Silurian) rocks of the Ekwan River and Sutton Mill Lake. Keewatin collection by D. B. Dowling in 1901, with descriptions of such species as appear to be new.

Report Bureau of Mines, 1912, vol. 21, part 2, pp. 157-168.

Crustacea Isochilinina or Leperditia sp. indet.

Calymmene Niagarensis Hall. *Illaenus* sp. indet. *Bronteus Ekwanensis* sp. nov., *B. aquilonaris* sp. nov. *Ceraurus Tarquinius* Billings.

These species were also described in Geol. Sur. Canada, Ann. Report, new ser., vol. 14, 1901, F. Appendix I, pp. 38-60.

White (David). Fossil Flora of the Coal Measures of Brazil.

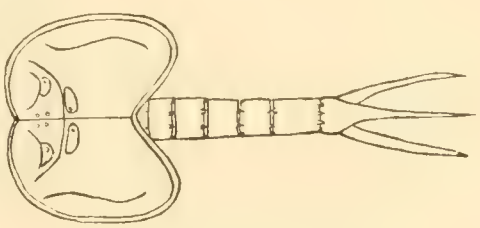
Commissão de Estudos das Minas de Carvão de Pedra do Brazil. Final Report by I. C. White, 1908.

David White describes under the name of *Hastimima whiteri* certain fragmentary remains from the Carbonic plant beds of Santa Catherinia—a doubtful plant, referred by palæontologists to the Eurypteridae as the genus Hastimima White.

Whitfield (R. P.) Contributions to the Palæontology of Ohio.

Geol. Survey Ohio, vol. 7, 1893, pp. 407-494, plates 1-13.

Eurypterus Eriensis Whitf., *Leperditia alta* Conrad. *Echinocaris sublevis* Whitf., *E. pustulosa* Whitf., *E. multinodosa* Whitf. *Palaeopalaemon Newberryi* Whits. *Aristozoe Canadensis* n. sp.



Echinocaris Punctatus Whitfield

——— Observations on the fauna of the rocks at Fort Cassin, Vermont, with descriptions of a new species.

Bull. Amer. Museum Nat. Hist., vol. 5, 1980, pp. 25-39, plates.

Bolbocephalus Seelyi n. gen. et sp., *B. truncatus* n. sp. *Bathyurus (Bathyurella) planicephalus* n. sp.

——— Notice and description of new species and new genus of Phyllocardæ.

Bull. Amer. Museum Nat. Hist., vol. 7, 1896, pp. 299-304.

Entomocaris Telleri n. gen. et sp. *Ceratiocaris Monroei* n. sp., *C. poduriformis* n. sp.

——— Note on the hypostoma of *Lichas* (*Terataspis*) *grandis*, Hall.

Bull. Amer. Museum Nat. Hist., vol. 9, 1897, pp. 41-42, figures.

WHITFIELD (R. P.)—Continued

——— and **Hovey** (E. C.) Catalogue of the type and figured specimens in the Palæontological collection of the Geological Department American Museum Natural History.

Bull. Amer. Museum Nat. Hist., vol. xi, 1900, 356 pp.

Williams (H.) assisted by **Breger** (C. L.) The Fauna of the Chapman Sandstone of Maine.

U. S. Geol. Sur. Prof. Papers No. 89, 1916.

The authors describe *Homalonotus laticaudatus* nov., distinguished from *H. delphinocephalus* by its broader pygidium, very much like the Rheinish Devonic sp., *H. crassicaeda* Sandb. *Homalonotus Vanuxemi* Hall. *Phacopidella Chapmani* nov., compares *P. anceps* and *P. mylanderi* Dalmanites ? (Synphoria) a and b sp. nov.

Ostracoda: *Ctenobolbina ? cornuta.*

Zygobeyrichia nov. gen. Genotype *Z. devonica* Jones and Woodward, 1889. The new generic name is proposed for a group of large Beyrichidae that seems to represent a departure from the type from the Silurian stock.

Zygobeyrichia apicalis nov. and *Z. extrema* nov. This is distinguished from *Z. apicalis* by its shorter and more gibbous form; and from species of Kloedenia it differs by the complete loss of the posterior lobe, the greater depth and length of the sulcus and the ventral prolongation, etc.

Williams (N. Y.) An Eurypterid Horizon in the Niagara Formation of Ontario.

Canada Dept. of Mines Mus. Bull. No. 20, Geol. ser. No. 29, 1915, pp. 51, pls. 5.

Wiman (Carl). Studien ueber das Nordbaltische Silurgebiet. 1.

Geol. Instit. Upsala, No. 11, vol. vi, part 1, 1902, with 4 plates and map.

Olenellus sp. *Paradoxides* sp. *Arionellus balticus* n. sp. *Ellipsocephalus latus* n. sp. *Ellipsocephalus* sp.

Aparchites ? Anderssoni n. sp., *A. ? fennicus* n. sp. *Beyrichona gevalensis* n. sp., *B. faba* n. sp., *B. ? alta* n. sp. *Ostracod* sp. *Sellula fallax* n. sp. *Bradorona nitida* n. sp. *Indiana ? minima* n. sp. *Hipponicharion Matthewi* n. sp.

Acerocare norvegicum Mbg. *Geratopyge forficula* Sars. *Shumardia oelandica* Mbg., *S. bottnica* n. sp. *Trilobite.*

The author gives a bibliography of the literature on the Baltic Silurian, with quotations and figures from Roberg's Dissertatio academica de fluviatili astaco ejusque usu medico, Upsala, 1715, p. 32; and refers his figure 1 to *Megalaspis limbata* Sars and Boeck; figure 2 to the pygidium of an *Asaphus.*

——— Ein Shumardiaschiefer bei Lanna in Nerike.

Arkiv. for Zoologi K. Svenska Vet. Ak. ad Stockhölm, Bd. 2, No. 11, 1905.

Apatocephalus pecten n. sp. *Megalaspis planilimbata* Ang., *M. nericiensis* n. sp. *Niobe laeviceps* Dalm. *Niobe* sp. Nos. 1 and 2. *Symphysurus breviceps* Ang. *Ampyx brevicauda* n. sp. *Agnostus glabratus* Ang., *A. glabratus* Ang. var. *ingricus* Fr. Schmidt, *A. lentiformis* Ang., *A.* sp. *Shumardia nericiensis* n. sp. *Orometopus* sp.

Wilson (Alice E.) and **Mather** (Kirtley F.) Appendix 11. Synopsis of the common fossils of the Kingston area.

25th Ann. Rep. Ontario Bureau of Mines, 1916, pp. 45-66, plates 1-3.

The authors illustrate as Black River fossils, Ordovician species. *Bumastus Milleri* (Bill.) and *Isotelus gigas* DeKay. *Bathyurus extans* Hall. *Onchometopus simplex* R. & N.

Ostracoda:

Isochilina armata Walc. *Leperditia fabulites* Conrad and *L. tumida* Ulrich.

Trenton Fossils:

Calymmene senaria Conrad. *Ceraurus dentatus* R. & B. and *Isotelus gigas* DeKay.

*Wood. On the classification of Trilobites. (Not seen.)

The Cambridge Natural History, vol. 4, 1909.

Wood (Elvira). Marcellus (Stafford) Limestone Erie County, N. Y.

Bull. New York State Mus., No. 49, 1901, pp. 139-181.

Phacops rana Green. *Cryphaerus Boothi* Green, *C. craspedota* Hall. *Primitopus punctulifera* Hall.

Woods (Henry). The Cambridge History. The Crustacea and Arachnids Eurypteridæ, 1909.

Vol. 4, Chapter xi, pp. 283-294.

Woodward (Henry). On some points in the structure of the Xiphosura, having reference to their relationship with the Eurypteridæ.

Quart. Jour. Geol. Soc. London, vol. 22, 1867, p. 28.

On page 32 the author uses the term Prestwichia for a new genus with *Prestwichia anthrax* Prest. for the type. This generic name was used by Lubbock in 1863, therefore it is a syn. and the genus *Euproops* Meek is available for the genus.

——— On the discovery of Trilobites in the Upper Green (Cambrian) slates of the Penrhyn Quarries, North Wales.

Quart. Jour. Geol. Soc. London, vol. 44, 1888, p. 74, pl. 6.

Concoryphe viola nov.

Its peculiar facial sutures suggest a new generic name.

——— Note on a collection of Carboniferous Trilobites from the Banks of the Hodder near Stonyhurst, Lancashire.

Geol. Mag., Dec. iv, vol. 1, 1894, p. 481, plate 14.

Phillipsia van-der-Grachtii n. sp., *P. Polleni* n. sp.

The author also gives figures of the pygidia of *Phillipsia Derbiensis* Martin and *P. gemmulifera* Phillips.

——— Contributions to our knowledge of the genus Cyclus from the Carboniferous formation of various British localities.

Cyclus Jonesianus H. W., *C. radialis* Phil., *C. Scottii* H. W., *C. Johnsoni* H. W., *C. Rankini* H. W.

Geol. Mag., Dec. iv, vol. 1, 1894, pp. 530-539, plate 15.

The curious little shield-like Crustaceans, classed under Cyclus, were first noticed by de Koninck in 1841—Descript. des Animaux Foss. Carb. de Belg. 1842, p. 591, plate 53—and have been subsequently illustrated and described by various authors.

——— On a collection of Trilobites from Coddon Hill beds, Lower Culm Measures near Barnstaple, Devon, and one from Glamorganshire.

Geol. Mag., Dec. iv, vol. 9, 1902, pp. 481-487, plate 20.

Griffithides Barksi n. sp. *Phillipsia spatulata* n. sp. *Proetus Goddonensis* n. sp.

For previous papers on the Culm Trilobites see: Henry Woodward, on the discovery of Trilobites in the Culm Shales, Geol. Mag., 1884, pp. 534-545, pl. xvi; Woodward Carboniferous Trilobites, Mon. Pal. Soc., 1883-1884, p. 1-86, plates I-x; G. J.

WOODWARD (Henry)—Continued

Hinde and Howard Fox, The Radiolarian rocks in the Lower Culm-measures, Quart. Jour. Geol. Soc., 1895, vol. 51, pp. 609-668, plates 23-28; note on the Trilobites, by Henry Woodward, pp. 646-649, plate 28, figures 1-8.

——— The Canadian Rockies. Part 1. On a collection of Middle Cambrian fossils obtained by Edward Whymper from Mount Stephen, B. C.

Geol. Mag., Dec. iv, vol. 9, 1902, pp. 529-544, 17 figures.

Ogygopsis Klotzi Rom. *Bathyuriscus Howelli* Walc., *B. (Kootenia) Dawsoni* Walc., *B. pupa* Matth. *Neolenus serratus* Rom., *N. granulatus* Matth. *Ptychoparia Cordillerae* Walc. *Zacanthoides (Olenoides) spinosus* Walc. *Oryctocephalus Walkeri* Matth., *O. Reynoldsi* F. R. Cowper Reed.

Conocephalites (Conaspis ?) cf. *perseus* Hall. *Corynexochus Roemeringeri* Matth. *Dolichometopus occidentalis* Matth. *Agnostus interstrictus* White, *A. montis* Matth. *Anomalocaris Canadensis* Whiteaves.

Dr. Henry Woodward, one of the best authorities on recent and fossil Crustacea, retains Rominger's genus Ogygopsis, and remarks that *Ogygopsis Klotzi* differs from Ogygia proper in having a well-defined ocular ridge and a narrow palpebral lobe. It seems convenient to separate this Rocky Mountain form generically from the other examples of Ogygia.

——— On two Trilobites from the Devonian Slates of Cornwall, obtained by Walter Barratt, Esq.

Geol. Mag., Dec. iv, vol. 10, 1903, pp. 28-31.

The author figures *Homalonotus Barratti* n. sp., and gives a list of English Devonian species of Devon and Cornwall.

Phacops latifrons ? Bronn—a fragment—is referred to this genus.

——— Note on some fragmentary remains of fossils from the upper part of Mount Noyes (Cambrian Rockies).

Geol. Mag., Dec. iv, vol. 10, 1903, pp. 297-299, three figures.

Olenellus Thompsoni Hall. *Olenellus* sp.

——— Notes on a series of Trilobites obtained by Mr. Howard Fox from the Devonian of Cant Hill, St. Minver, Cornwall.

Geol. Mag., Dec. v, vol. 2, 1905, pp. 151-154, plate 5.

Phacops latifrons Bronn., *P. granulatus* Münster, *P. (Cryphaeus) punctatus* Stein.

——— On a collection of Trilobites from the Upper Cambrian of Shantung, North China.

Geol. Mag., Dec. v, vol. 2, 1905, pp. 211-215—continued on p. 251-255, plate 13.

This article contains an abstract of Herr H. Monke's paper, entitled, "Contributions to the Geology of Shantung—1. Upper Cambrian Trilobites from Yen-tsy-yai," Jahrb. d. k., Preeuss Geol: Landesanstalt and Bergakademie, 1902, vol. 23, pp. 103-151, pl. 3-9.

The author illustrates *Drepanura Premesnili* Bergeron (which, like *D. Ketteleri* Monke, is founded upon pygidia and separate and imperfect head shields, also with elongated cheek-spines. The lateral caudal spines are very much more elongated in *D. Ketteleri* and remind one of the very long lateral cheek and caudal spines of *Bathynotus holopyga* Hall).

Stephanocare Richthofeni Monke, referred to the genus Olenoides in the text, p. 254, fig. 2.

WOODWARD (Henry)—Continued

——— Notes on some Crustaceans and two Myriopods from the Lower Coal measures near Colne, Lancashire.

Geol. Mag., Dec. v, vol. 2, 1905, pp. 437-44.

Decapoda: Macroura *Anthrapalaemon serratus* n. sp., *A. Woodwardi* R. Etheridge, *A. Traquairii ?* Peach.

——— Further note on *Cyclus Johnsoni* from the Coal Measures Dudley.

Geol. Mag., Dec. v, vol. 2, 1905, pp. 490-492.

——— Two new species of Eurypterus from the Coal Measures Ilkeston.

Geol. Mag., Decade v, vol. 4, 1907, pp. 277-282, plate 13.

Eurypterus Moyseyi n. sp., *E. Derbiensis* n. sp.

The author gives a sketch of the Carboniferous Euryptidae.

——— On the genus Pygocephalus (Huxley), a primitive Schizopod Crustacean from the Coal Measures.

Geol. Mag., Decade v, vol. 4, 1907, pp. 400-407, plate xviii.

Pygocephalus Cooperi Huxley, *P. (Anthrapalaenon) Parkeri* n. sp., fig. 2, in text.

——— Further notes on the Arthropoda of the British Coal Measures.

Geol. Mag., Decade v, vol. iv, 1907, pp. 539-549.

Bellinurus Baldwini n. sp., *B. longicaudatus* n. sp.

——— Note on the genus Hastimima from Brazil and Cape.

Geol. Mag., Decade v, vol. 6, 1909, pp. 486-88.

——— On a pygidium of Bronteus from the Devonian of Gerolstein Eifel, preserved in the collection of the late Mr. Townshend M. Hall, in the Athenaeum, Barnstaple.

Geol. Mag., Decade v, vol. 7, 1910, pp. 407-410, figures.

The author figures *Bronteus Halli* sp. nov., *B. thysanopeltis* Barr., *B. speciosus* Corda.

——— Note on a new species of Caryocaris (*C. Kilbridensis*) from the Arenig rocks of the Kilbride Peninsula.

Quart. Jour. Geol. Soc. London, vol. 68, p. 99, 1912.

The species approaches the *Caryocaris wrightii* Salter.

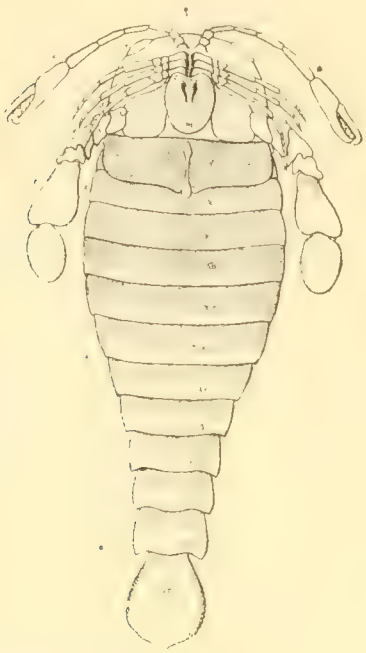
The author notes near the centre of the carapace two round bodies which appear to be eggs, and may possibly be homologous with the pair of ephippial eggs so often observed in Daphnia.

WOODWARD (Henry)—Continued

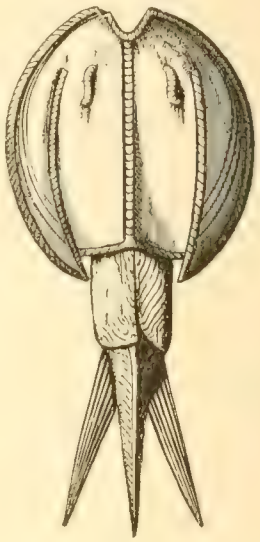
——— The position of the Merostomata.

Geol. Mag., Decade v, No. 7, July, 1913, p. 293, two text figures.

The author gives a sketch of the genus from McCoy's weird restoration of *Pterygotus problematicus,* in fifth edition of Lyell's Manual of Elementary Geology, 1855, p. 420.



Pterygotus Anglicus.



Dithyrocaris Scouleri

Also the further discoveries of Pterygotus, made by Robert Slimon in the Geol. Sur. Memoir in 1859, illustrated by 16 plates and text figures.

Salter contributed a restoration of *Pterygotus anglicus* to Murchison's Siluria, 1859, edition. He gives only two pairs of appendages to the head. The operculum is placed in front of the mouth, and the lower lip or metastoma is absent.

Dr. Nieszkowski, in his paper on *Eurypterus remipes,* gives restorations of the upper and under sides of Eurypterus, showing the appendages of the mouth in situ and the thoracic plates on the under side of the body.

Other restoration of several forms of Pterygotus Stylonurus Eurypterus, without descriptions, are given in David Page's Advanced Text Book of Geology, 1859, all more or less correct.

Excellent descriptions and figures of American species of Eurypterus and Pterygotus are given by James Hall in Palæont. New York, vol. 3, pt. 1, pp. 382-419, 80 plates and 10 additional plates, the accuracy of which still remains unchallenged.

Mr. J. W. Salter, in the Quart. Jour. Geol. Soc., 1862 and 1863, contributed descriptions of Eurypterus and allied form of Pterygotus.

Dr. Henry Woodward figured and described a very complete example of *Slimonia acuminata* in the Intellectual Observer, 1863, vol. 4, p. 229; also of *Eurypterus lanceolatus* in the Geol. Mag., 1864, vol. 1, p. 107, pl. 5, figs. 7-9. In 1865 he figured and described *Stylonurus scoticus, S. Powerici, S. Symondsi Hemiaspis limuloides* in the

WOODWARD (Henry)—Continued

Quart. Jour. Geol. Soc., vol. 21, pp. 482-92, plates 13-14. The same author, in 1866, commenced a Monograph of the British Crustacea of the Order Merostomata, published in the Palæont. Soc., 1866-1878, in which 14 genera and 83 species are recorded, described and illustrated.

The author does not include in this historical sketch the paper by DeKay, 1825, who gave the generic name of Eurypterus, or reference to Mitchell's paper in the Am. Monthly Mag., vol. 3, 1888, p. 291, in which he describes the now well-known *Eurypterus remipes* DeKay, as a fossil fish.

Woodward quotes the well-known paper by Dr. Holm, St. Petersburg Academy, 1896, and his investigations of *Eurypterus fischeri* from the Island of Oesel. In this locality the fossils are not metamorphosed into carbonaceous film, as in other deposits, and he was able to elaborate its organization in such detail that *E. fischeri* has really become the most completely known of all extinct animals.

Woodward's paper includes two full-page figures of *Eurypterus fischeri,* from Holm's paper.

The paper closes with a notice of Dr. Clarke and Ruedemann's memoir on the Eurypterida of New York, noted in this Bibliography.

——— *Rochdalia Parkeri* by Henry Woodward.

Geol. Mag., Decade v, No. 8, vol. 10, p. 352, 1913.

This new genus and species from the Coal Measures of Rochdale, the author places with the Branchiopoda in the order Anostraca.

Zelizoko (J. V.) Geologisch—palæontologische Verhältnisse der nächsten Umgebung von Rozmital in Bohemen.

Bull. Acad. Sci. de Bohéme, 1906, 2 plates.

Trinucleus Alfredi nov. *Dionide formosa* Barr. *Phacops (Chasmops) Bohemicus* nov. Calymmene sp. Dalmania sp.

Zimmermann (Hugo). Trilobiten aus dem devonkalk des Rittberg bie Czellechowitz.

Verhandl. des Naturf. Vereins in Brünn, Bd. xxx, 1891, plate.

Dechenella rittbergensi n. sp., p. 119, pl. 1, fig. 4. Referred by Richter to the subgenus Eudechenella.

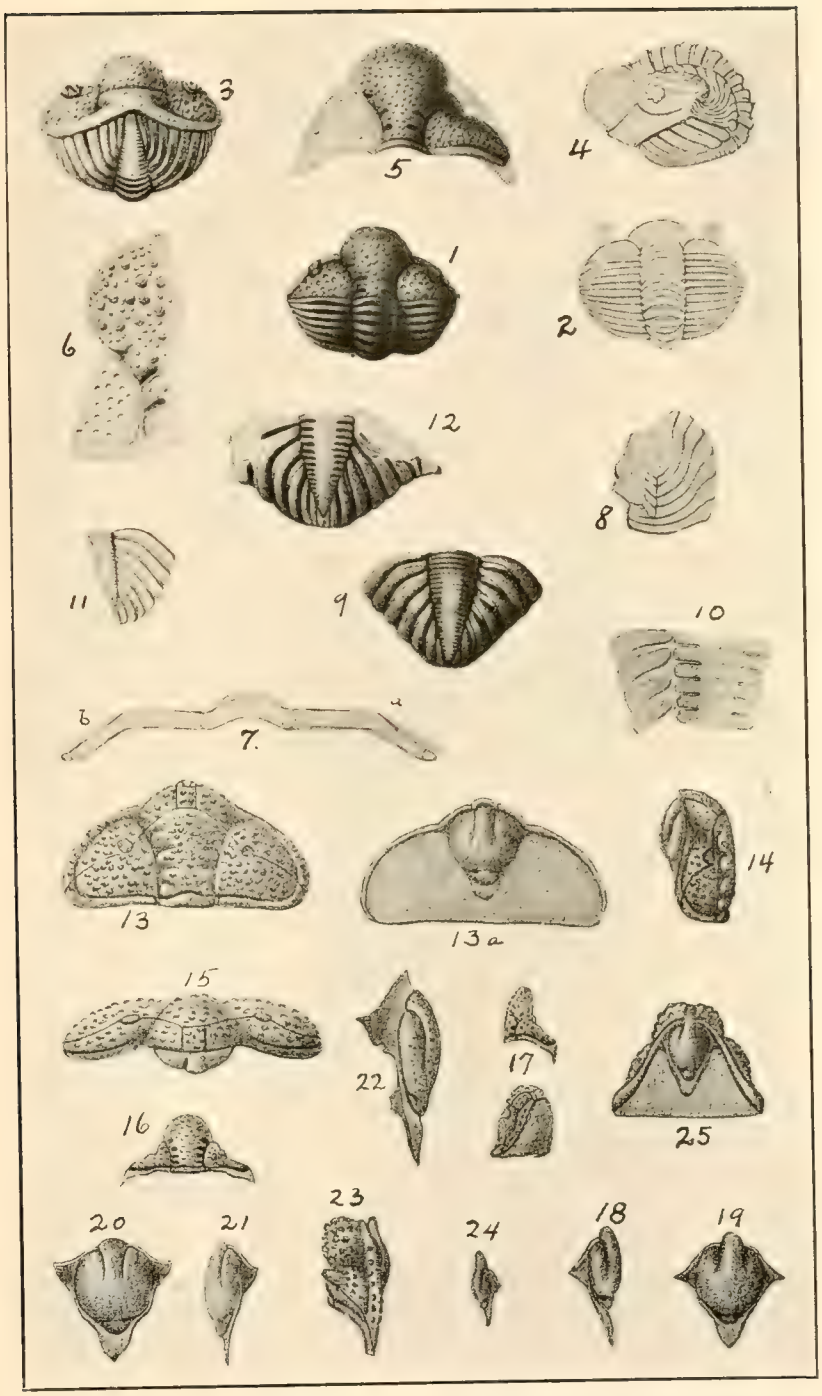
The author figures and describes *Bronteus alutaceus* Goldf. *Dechenella Verneuli* Barr. Referred by Richter to *D. Rittbergensis.*

Cyphaspis granulosus Steininger and Proetus sp. Referred by Richter to *Schizoproetus celechovicensis* Smycka.

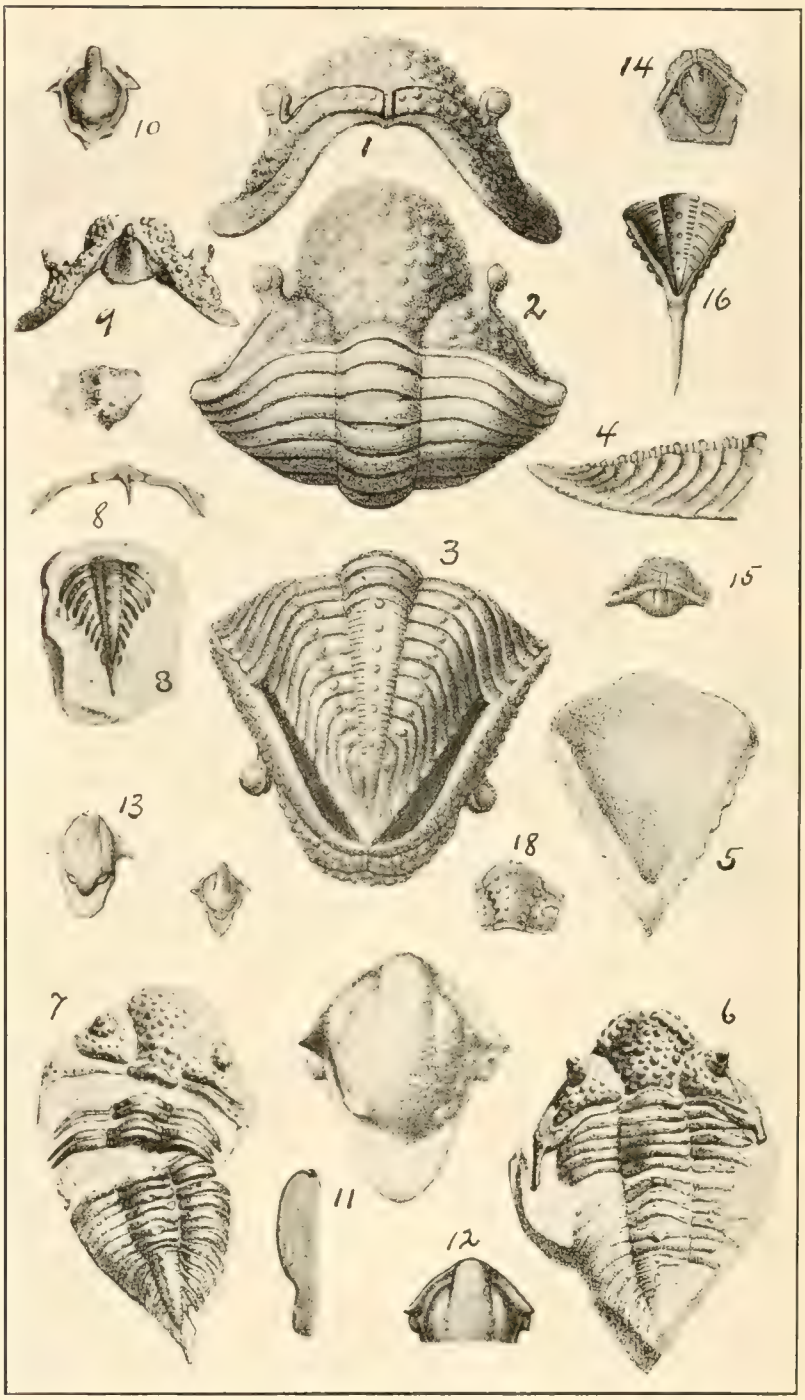
Zuber (Rudolf). Najdawniejszy swiat organiczny i najstarsze formacye osadowe Napisal.

Kosmos polski, vol. 23, 1899, pp. 12-24.

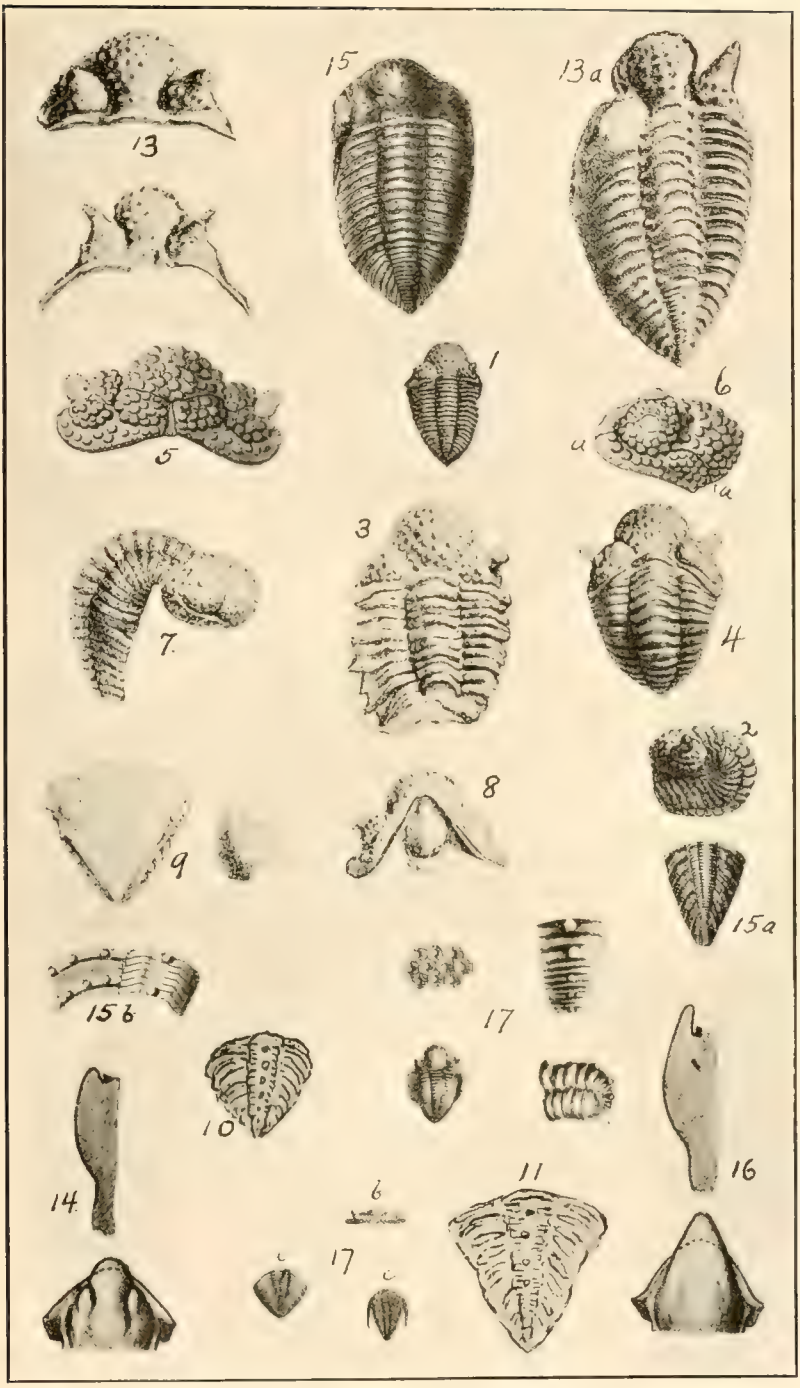
The author illustrates *Olenellus Thompsoni* and *Mesonacis vermontana.*



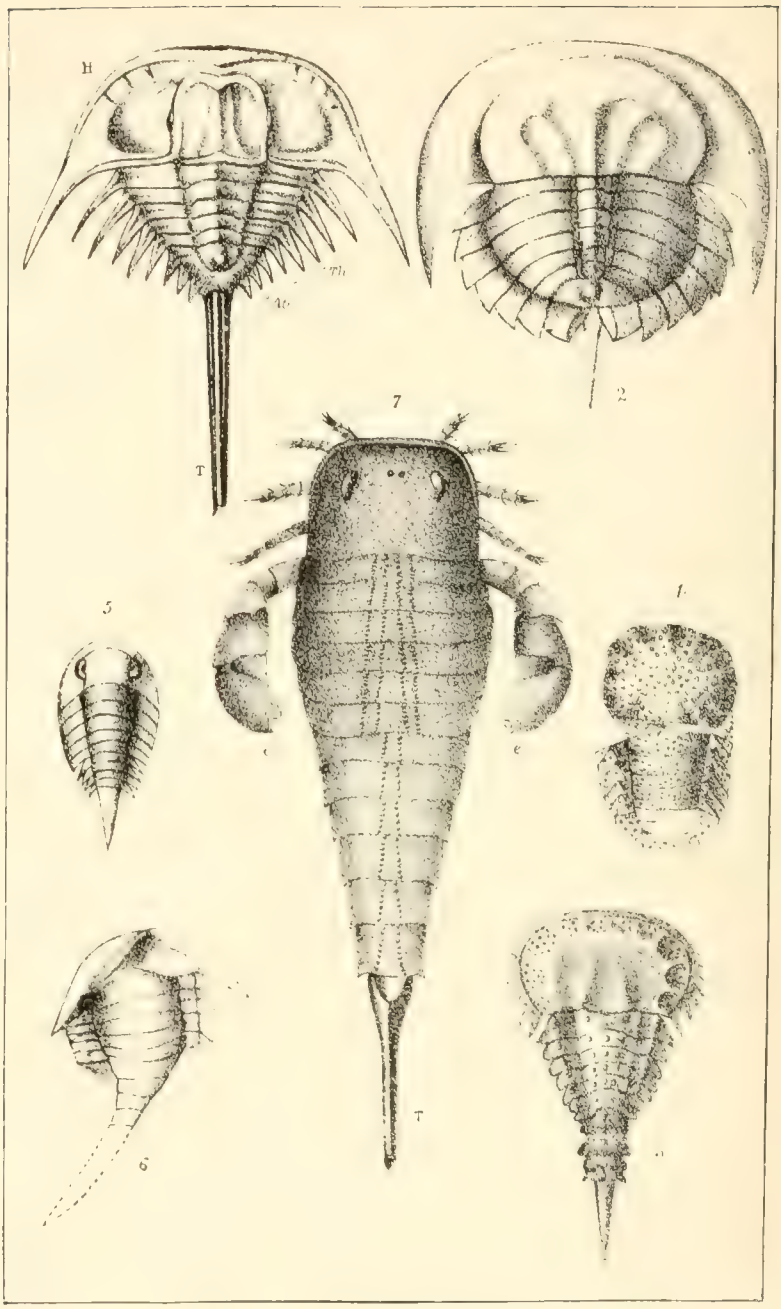
Figs. 1-12. Encrinurus sex-costatus.
Figs. 13-15. Encrinurus (Cromus), Beaumonti.
Figs. 16-19. E. (Cromus) transiens.
Figs. 20-22 E. (Cromus) Bohemicus.
Figs. 23-24. Encrinurus punctatus.



Encrinurus punctatus.

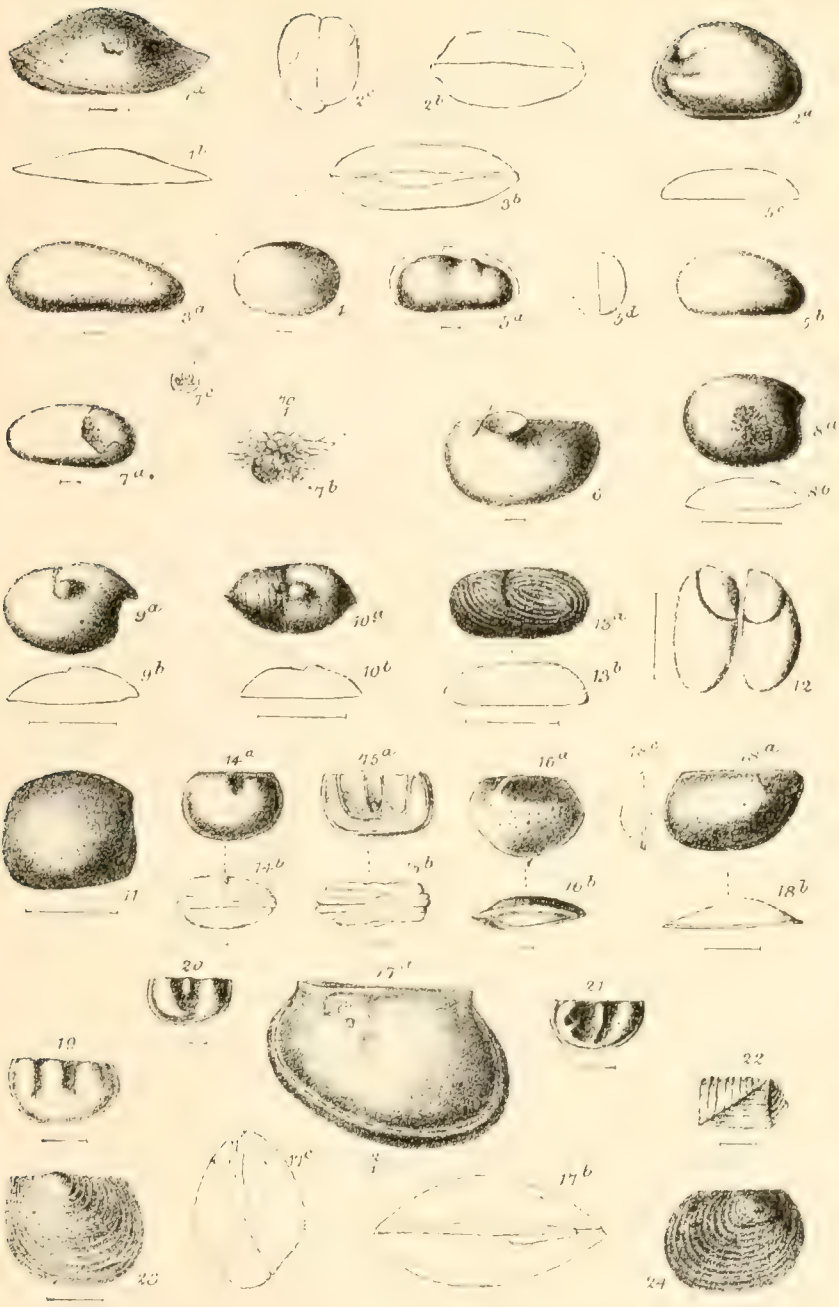


Figs. 1-10. Cryptonymus variolaris.
Fig. 11. Linne's fig. of pygidium.
Fig. 12. Pygidium Encrinurus multi-segmentatus.
Fig. 13. E. Eagani.
Fig. 14. E. obtusus.
Fig. 15. E. ornatus.
Fig. 16. E. laevis.
Fig. 17. Cybele vigilans.



(The figures copied after Dr. Henry Woodward's plate, Proc. Geol. Soc., vol. 23, 1867.)

Fig. 1. Belinurus reginae Baily Coal Measures, Ireland.
Fig. 2. Euproops rotundata Prestwich Coal Measures, Eng.
Fig. 3. Hemiaspis limuloides. H. Woodward, Ludlow, Eng.
Fig. 4. Bunodes limula Eichwald Silurian, Baltic.
Fig. 5. Pseudoniscus aculeatus Nieszkowski Sil., Baltic.
Fig. 6. Exapinurus Schrenkii Nieszkowski Silurian, Baltic.
Fig. 7. Eurypterus remipes De Kay Silurian, New York.



(The figures are copied after T. Rupert Jones's plate, Monthly Microscopical Jour., 1870.)

Fig. 1. Bairdia curta McCoy.
Fig. 2. Thlipsura corpulenta Jones & Holl.
Fig. 3. Cythere Jukesiana J. & H.
Fig. 4. Cytherella brevis Jones.
Fig. 5. Cytherellina siliqua Jones
Fig. 6. Æchmina cuspidata J. & H.
Fig. 7. Carbonia Agnes Jones.
Fig. 8. Cypridina Phillipsiana Jones.
Fig. 9. Cypridella Koninckiana Jones.
Fig. 10. Cyprella subannulata Jones.
Fig. 11. Entonoconchus Scouleri McCoy.
Fig. 12. Entomis divisa Jones.
Fig. 13. Entomis biconcentrica Jones.
Fig. 14. Primitia renulina J. & H.
Fig. 15. Kirkbya Urei Jones.
Fig. 16. Moorea silurica J. & H.
Fig. 17. Leperditia Balthica Hisinger.
Fig. 18. Isochilina gracilis Jones.
Fig. 19. Beyrichia Wilckenziana Jones.
Fig. 20. Beyrichia Kloedeni McCoy.
Fig. 21. Beyrichia complicata Salter.
Fig. 22. Leaia Leidyi Lea.
Fig. 23. Estheria membranacea Patch.
Fig. 24. Estheria tenella Jordan.

AN ANNOTATED LIST OF THE BIRDS OF SAN DIEGO COUNTY, CALIFORNIA

By FRANK STEPHENS

SMITHSONIAN INSTITUTION
SEP 30 1925
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Water Birds

Order PYGOPODES. Diving Birds.

Excellent divers, obtaining their food principally under water; the food consisting of small fishes, water beetles, larvæ and other aquatic life. They prefer escaping from their enemies by diving rather than by flight. Innocuous, with the possible exception of consuming small quantities of young fish.

Family COLUMBIDÆ. Grebes.

1. WESTERN GREBE. **Æchmorphus occidentalis.**

Rather common winter residents (Sept. to April) on the ocean and bays along the coast. A few are found in winter on the larger fresh water ponds and reservoirs.

2. HORNED GREBE. **Colymbus auritus.**

Occasional winter visitants off shore, rare on bays and inland waters. Immature birds are difficult to distinguish from immature birds of the next species.

3. EARED GREBE. **Colymbus nigricollis californicus.**

Common winter residents on salt and fresh waters of the county. A few remain through the summer on tule-bordered fresh water ponds and breed. Not as abundant as they were before plume hunters began killing them for the skins of their breasts.

4. PIED-BILLED GREBE. DABCHICK. **Podilymbus podiceps.**

Present in small numbers all the year. Breed about tule-bordered marshes and ponds. Also found on salt water in winter. The winter residents go north in spring and are replaced by newcomers from the south.

Family GAVIIDÆ. Loons.

5. COMMON LOON. **Gavia immer.**

Common winter residents (October to April) along the coast and on the bays, occasional on reservoirs and lakes containing fish.

6. PACIFIC LOON. **Gavia pacificus.**

Rather common at the same time and places as the preceding, except that they are not known to go any distance inland.

7. RED-THROATED LOON. **Gavia stellata.**

Rather rare winter visitant. Found only on salt water.

Family ALCIDÆ. Auks, Murres. Puffins.

8. RHINOCEROS AUKLET. **Cerorhinca monocerata.**
Rather common winter residents off shore. Occasionally dead birds are found washed ashore on beaches.

9. CASSIN AUKLET. **Pytocramphus aleuticus.**
More or less abundant at sea all the year. Breed on the Coronado Islands. Dead birds wash ashore occasionally.

10. ANCIENT MURRELET. **Sinthliboramphus antiquus.**
Found occasionally off shore in winter. A dead bird was found on the beach at Pacific Beach.

11. XANTUS MURRELET. **Brachyramphus hypoleucus.**
Rather common at sea all the year. Breed on the Coronado Islands.

Order LONGIPENNES. Long-winged Swimmers.

Birds of this order feed on fish swimming near the surface of the water and on offal floating on the surface, occasionally on material picked up on land. Fish are obtained by plunging down on them from the air. The fish are mostly small species but little used for human food.

Family STERCORARIDÆ. Jægers.

12. POMARINE JÆGER. **Stercorarius pomarinus.**
Occasional off shore, principally in the migrations.

13. PARASITIC JÆGER. **Stercorarius parasiticus.**
Occasional along the coast in fall and winter.

14. LONG-TAILED JÆGER. **Stercorarius longicaudus.**
One taken at Pacific Beach Sept. 19, 1904.

Family LARIDÆ. Gulls and Terns.

15. PACIFIC KITTIWAKE. **Rissa tridactyla pollicaris.**
Occasional off shore in winter.

16. GLAUCOUS-WINGED GULL. **Larus glaucescens.**
Occasional along the coast in winter.

17. WESTERN GULL. **Larus occidentalis.**
Abundant residents of bays and coasts. Rare inland. Breed on the Coronado Islands.

18. HERRING GULL. **Larus argenteus.**
Rather common winter residents of the coast and bays. Occasional about fresh waters.

19. CALIFORNIA GULL. **Larus californicus.**
Common winter residents (Sept. to May) of coast and bays, and rather common on fresh waters. Sometimes follows the plow to pick up larvæ and worms.

20. RING-BILLED GULL. **Larus delawarensis.**
Common winter residents of coast and bays (Sept. to May). Occasional inland.

21. SHORT-BILLED GULL. **Larus brachyrhynchus.**
Rare winter visitant along the coast.

22. HEERMANN GULL. **Larus heermanni.**
Rather common on bays and along the coast in summer, fall and winter. Contrary to the custom of most birds Heermann Gulls go south in spring to breed, on the islands off the Mexican coast.
23. BONAPARTE GULL. **Larus philadelphia.**
Rather common migrant, both along the coast and in the interior. A few remain along the coast in winter.
24. CASPIAN TERN. **Sterna caspia.**
Rare migrant. Has been taken at San Diego.
25. ROYAL TERN. **Sterna maxima.**
Rather rare winter residents along the coast. Go in small flocks.
26. ELEGANT TERN. **Sterna elegans.**
Rare or irregular winter visitant along the coast.
27. FORSTER TERN. **Sterna forsteri.**
Found sparingly along the coast nearly all the year. Common in the migrations when they also appear inland.
28. COMMON TERN. **Sterna hirundo.**
Occasional along the coast in the migrations.
29. LEAST TERN. **Sterna antillarum.**
Common summer residents, breeding at several places on the beach. Apparently not found inland.
30. BLACK TERN. **Hydrochelidon niger surinamensis.**
Rather common about fresh waters containing small fish in summer. Migrates along the coast.

Order TUBINARES. Tube-nosed Swimmers.
Marine, many species being found far at sea. Food and habits similar to those of gulls.

Family DIOMEDIIDÆ. Albatrosses.
31. BLACK-FOOTED ALBATROSS. **Diomedea nigripes.**
32. SHORT-TAILED ALBATROSS. **Diomedea albatrus.**
Frequently seen off the coast at all times of the year. Dead birds occasionally wash ashore.

Family PROCELLARIDÆ. Fulmars and Shearwaters.
33. PACIFIC FULMAR. **Fulmaris glacialis glupischa.**
Common at sea in winter. Dead birds frequently wash ashore. Dichromatic; the black phase is most often found here.
34. RODGERS FULMAR. **Fulmaris rodgers .**
Found with the Pacific Fulmar, but in smaller numbers.
35. PINK-FOOTED SHEARWATER. **Puffinus creatopus.**
Rather common at sea in summer and fall.
36. BLACK-VENTED SHEARWATER. **Puffinus opisthomelas.**
More or less abundant at sea in summer after the close of the breeding season; occasionally seen near the b ach. They leave for their breeding grounds on islands off the Mexican coast in March.

37. SOOTY SHEARWATER. **Puffinus griseus.**
Common at sea all the year. Most common in summer.
38. SLENDER-BILLED SHEARWATER. **Puffinus tenuirostris.**
Occasional at sea in winter.
38a. FORK-TAILED PETREL. **Oceanodroma furcata.**
I found a dead Fork-tailed Petrel washed up on the beach at Ocean Beach December 23, 1918. This is the southermost record for this Petrel. Their range is the north Pacific Ocean.
39. SOCORRO PETREL. **Oceanodroma socorroensis.**
Common at sea throughout the year. Breeds on the Coronado Islands.
40. BLACK PETREL. **Oceanodroma melania.**
Common at sea all the year. Breeds on the Coronado Islands.

Order STEGANOPODES. Totipalmate Birds.

Fish eating birds, mostly marine in distribution, but a few species frequent fresh waters. The fish eaten are usually small, but some are young fish that would be of economic importance full grown. The Cormorants usually pursue their prey under water, but the Pelecans scoop theirs up from the surface or plunge down on them from the air. Most species of this order are social in habit, particularly in the breeding season.

Family PHALACROCORACIDÆ. Cormorants.

41. FARALLONE CORMORANT. **Phalacrocorax auritus albociliatus.**
Common resident along the coast. Occasional inland on fresh waters. Breed on rocky cliffs over the water.
42. BRANDT CORMORANT. **Phalacrocorax penicillatus.**
Common resident along the coast. Not found on fresh waters. Breeds on the Coronado Islands.
43. BAIRD CORMORANT. **Phalacrocorax pelagicus resplendens.**
Resident along the coast and on the islands, but not as abundant as either of the other species. Found only about salt water.

Family PELECANIDÆ. Pelecans.

44. WHITE PELECAN. **Pelecanus erythrorhynchus.**
Occasionally seen in this county, in flight or about fresh waters, in fall or winter.
45. CALIFORNIA BROWN PELECAN. **Pelecanus californicus.**
Abundant at sea, along shore and on bays. Not found on fresh waters. Breeds on the Coronado Islands.

Family FREGATIDÆ. Man-o'-war Birds.

46. MAN-O'-WAR BIRD. **Fregata aquila.**
Stragglers from Mexican waters occasionally appear along the coast.

Order ANSERES. Lamellirostral Swimmers.

Swimming birds of wide distribution, mostly on fresh waters. The feeding habits vary greatly; some species being vegetarian, while others eat animal food or combine it with vegetation in some form. Most of the species are edible, and being of medium or large size furnish an important amount of human food. The order is a large one containing numerous genera, mostly belonging to one family.

Family ANATIDÆ. Ducks, Geese and Swans.

47. AMERICAN MERGANSER. **Mergus americanus.**
48. RED-BREASTED MERGANSER. **Mergus serrator.**
49. HOODED MERGANSER. **Lophodytes cucullatus.**

The Mergansers are rare winter visitors, and are mostly found on salt waters. They are fish eaters and are not edible.

50. MALLARD. **Anas platyrhynchos.**

Common winter residents, principally on fresh waters. Occasional summer residents, breeding about lakes and in marshes.

51. **Chaulelasmas streperus.**

Rather common winter residents on fresh waters. More plentiful in the migrations.

52. BALDPLATE. WIDGEON. **Mareca americana.**

Common winter residents, principally on fresh waters.

53. GREEN-WINGED TEAL. **Nettion carolinense.**

Common winter residents, principally on fresh waters.

54. BLUE-WINGED TEAL. **Querquedula discors.**

Rare winter visitants.

55. CINNAMON TEAL. **Querquedula cyanoptera.**

Common spring migrants. A few remain through the summer and breed about lakes and in marshes. Found only on fresh waters.

56. SHOVELER. SPOONBILL DUCK. **Spatula clypeata.**

Abundant winter resident, principally on fresh waters.

57. PINTAIL. SPRIGTAIL. **Dafila acuta.**

Abundant winter residents, principally on fresh waters.

58. WOOD DUCK. **Aix sponsa.**

Rare winter visitant. Two specimens taken in this county are in museums.

59. **Marila americana.**

Common winter residents, principally on fresh waters.

60. CANVASBACK. **Marila valisneria.**

Rather common winter residents along the seacoast. Rare in the interior. Redhead Ducks are often mistaken for Canvasbacks

61. SCAUP DUCK. BLUE-BILL. **Marila marila.**

Rare winter visitants along the seacoast.

62. LESSER SCAUP DUCK. BLUE-BILL. **Marila affinis.**

Common winter residents on salt and fresh waters.

63. RING-NECKED DUCK. **Marila collaris.**

Occasional winter visitant.

64. BUFFLEHEAD. BUTTER-BALL. **Charitonetta albeola.**
Common winter residents (Nov. to March), principally on salt waters.
65. OLD SQUAW. **Harelda hyemalis.**
Occasional winter visitant.
66. WHITE-WINGED SCOTER. **Oidemia deglandi.**
Common winter residents on bays and at sea. A few non-breeding birds remain through the summer.
67. SURF SCOTER. **Oidemia perspicillata.**
Abundant winter residents on bays and at sea. Both species of Scoters are fish and shell eating ducks and are not edible.
68. RUDDY DUCK. **Erismatura jamaicensis.**
Abundant winter residents and common in summer. Frequent both fresh and salt waters.
69. LESSER SNOW GOOSE. **Chen hyperboreas.**
Formerly abundant winter residents, now much less plentiful. Usually seen in flocks of considerable size. The food is mostly green vegetation, such as growing grain and grass.
70. WHITE-FRONTED GOOSE. **Anser albifrons gambeli.**
Formerly common winter residents. Usually found in small flocks and sometimes singly.
71. HUTCHINS GOOSE. **Branta canadensis hutchinsi.**
Formerly common winter residents, now much diminished in numbers.
72. CACKLING GOOSE. **Branta canadensis minima.**
This small "Honker" probably comes this far south in winter, but I know of no example from this county in any collection.
73. BLACK BRANT. **Branta nigricans.**
Formerly rather common winter residents, now rare. Seldom found on fresh waters.
74. FULVOUS TREE DUCK. **Dendrocygna bicolor.**
Rather common spring migrant. Rare winter visitant. Stragglers may remain through the summer and breed. Found on fresh waters.
75. WHISTLING SWAN. **Olor columbianus.**
Rare winter visitants.

Order HERODINES. Herons, Ibises, etc.

Wading birds frequenting marshes or the borders of ponds, lakes and bays for food, catching frogs, minnows, insects or other aquatic forms of life of no economic importance except in a very general way. Most species are not edible.

Family IBIDIDÆ. Ibises.

76. WHITE-FACED GLOSSY IBIS. **Plegadis guarauna.**
Rather common spring migrants. Breed in small numbers about suitable marshes in the warmer valleys. Edible, the only species of the order found here that is edible. This is the "Black Curlew" of sportsmen. While externally they resemble curlews technically they are not at all closely related.

Family CICONIIDÆ. Storks.

77. WOOD IBIS. **Mycteria americana.**

Irregular or casual summer visitors, mostly young birds that have straggled from their breeding grounds on the shores of the Gulf of California.

Family ARDEIDÆ. Herons.

78. AMERICAN BITTERN. **Botaurus lentiginosus.**

Rather common winter residents of marshes. Probably a few remain in summer and breed.

79. LEAST BITTERN. **Ixobrychus exilis.**

Very secretive and seldom seen. Probably rather common summer residents in tule marshes.

80. GREAT BLUE HERON. **Ardea herodias.**

Present through the year in small numbers.

81. AMERICAN EGRET. **Herodias egretta.**

Formerly a rather common resident, but now almost exterminated by plume hunters. Seen occasionally in the migrations.

82. SNOWY EGRET. SNOWY HERON. **Herodias candidissima.**

Formerly rather common winter residents. So nearly exterminated by plume hunters that none have been seen in this county for several years.

83. LOUISANA HERON. **Hydranga tricolor ruficollis.**

One taken at the south end of San Diego Bay in January, 1914.

84. ANTHONY GREEN HERON. **Butorides virescens anthonyi.**

Common migrants. Rare summer residents.

85. BLACK-CROWNED NIGHT HERON. **Nycticorax nycticorax nævius.**

Common migrants. Rare summer residents. More common in winter.

Order PALUDICOLÆ. Cranes and Rails.

Family GRUIDÆ. Cranes.

Large, heron-like birds frequenting plains and open ground. The food is frogs, grasshoppers, beetles, seeds, etc. Edible.

86. LITTLE BROWN CRANE. **Grus canadensis.**

87. SANDHILL CRANE. **Grus mexicana.**

The Cranes migrate in considerable flocks in fall and spring, often without stopping in the county. Occasional in winter on grass or grain fields.

Family RALLIDÆ. Rails, Gallinules, Coots.

Medium or small sized birds inhabiting marshes or ponds with grassy shores. Most species are shy and hide in grass, tules or weeds. The food is frogs, minnows, water beetles, larvæ, etc. The larger rails are edible.

88. LIGHT-FOOTED RAIL. CALIFORNIA CLAPPER RAIL. **Rallus levipes.**

Formerly common residents of the salt marshes along the coast. Now nearly exterminated by persistent hunting.

89. VIRGINIA RAIL. **Rallus virginianus.**

Rather common migrants. Rare summer residents of fresh water marshes.

90. CAROLINA RAIL. SORA. **Porzana carolina.**

Rather common migrants. Occasional throughout the year.

91. CALIFORNIA BLACK RAIL. **Creciscus coturniculus.**

Rare residents of salt marshes along the coast.

92. FLORIDA GALLINULE. **Gallinula galeata.**

Rather rare residents of tule bordered ponds.

93. COOT. MUD HEN. **Fulica americanus.**

Abundant residents of fresh water lakes and ponds.

Order LIMICOLÆ. Shore Birds.

Family PHALAROPIDÆ. Phalaropes.

A small family of rather small birds with feet partly webbed, thus connecting the swimmers with the shore birds. Their habits are also intermediate as they feed partly on insects picked up on shores of streams and ponds and also take part of their food while swimming on the surface of the water. Most species breed in the arctic regions.

94. RED PHALAROPE. **Phalaropus fulicarius.**

Abundant migrants at sea. Common migrants inland. Considerable numbers remain off shore all winter.

95. NORTHERN PHALAROPE. **Lobipes lobatus.**

Rather common migrants along the coast and inland.

96. WILSON PHALAROPE. **Steganopus tricolor.**

Rare migrants in this county.

Family RECURVIROSTRIDÆ. Avocets and Stilts.

A small family of medium sized, very long-legged birds, that frequent the shores of ponds and lakes, feeding on the insect life found in the water or on the shores. Although the webs at the base of the toes are quite small these birds are good swimmers, though they prefer wading. Edible.

97. AVOCET. **Recurvirostra americana.**

Rather common migrants.

98. BLACK-NECKED STILT. **Himantopus mexicanus.**

Rather common migrants. Probably rare summer residents, as I have found the species breeding in Orange county.

Family SCOLOPACIDÆ. Snipe, Sandpipers, Curlews, etc.

This is a large family of rather small birds that frequent the shores of streams, ponds, lakes and ocean beaches, feeding on the great variety of small animal life found at the waters edge, or in wet places. Many species wade more or less; none are habitual

swimmers. Most species large enough to be worth while are edible. None of the species are directly harmful to man's interests.

99. WILSON SNIPE. JACK SNIPE. **Gallinago delicata.**

Common spring and fall migrants. Occasional winter residents of wet grassy localities. Occur in small companies.

100. LONG-BILLED DOWITCHER. **Macrorhamphus scolopaceus griseus.**

Common spring and fall migrants along the coast. Winter residents in small numbers. Uusually found in flocks with other shore birds.

101. KNOT. **Tringa canutus.**

Rather common migrants along the coast and occasional winter residents.

102. BAIRD SANDPIPER. **Pisobia bairdii.**

Migrates principally through the Colorado valley and eastward. One bird has been taken at Pacific Beach.

103. LEAST SANDPIPER. **Pisobia minutilla.**

Abundant migrants and common winter residents along the coast, also common migrants in the interior.

104. RED-BACKED SANDPIPER. **Pelidna alpina sakhalina.**

Abundant migrants along the coast. A few remain through the winter.

105. WESTERN SANDPIPER. **Ereunetes mauri.**

Abundant migrants and common winter residents along the coast.

106. SANDERLING. **Calidris leucophæa.**

Rather common winter residents of the coast and bays.

107. MARBLED GODWIT. **Limosa fedoa.**

Common spring and fall migrants along the coast.

108. GREATER YELLOW-LEGS. **Totanus melanoleucus.**

Rather common migrants in the interior. Comparatively rare in the coast region.

109. WESTERN SOLITARY SANDPIPER. **Heleodromas solitarius cinnamomeus.**

Rather common migrants. Found on fresh and salt waters. Often found singly.

110. WESTERN WILLET. **Catoptrophorus semipalmatus inornatus.**

Rather common winter residents along the coast. Abundant migrants. Occasional about fresh waters.

111. WANDERING TATTLER. **Heteractitis incanus.**

Occasionally seen in the migrations or in the winter on rocky shores.

112. SPOTTED SANDPIPER. **Actitis macularius**

Rather common winter residents around fresh and salt waters. Prefers rocky shores. Found singly or in small companies.

113. LONG-BILLED CURLEW. **Numenius americanus.**

Formerly abundant in the migrations, now moderately common. Most often seen on the sea beaches and bay shores, but also found on fresh waters.

114. HUDSONIAN CURLEW. **Numenius hudsonius.**
Common migrants along the coast, occasionally seen around fresh waters.

Family CHARADRIIDÆ. Plovers.

Medium and small sized birds similar in form and habits to those of the preceding family, except that the birds have shorter and heavier bills and are not as closely restricted to the neighborhood of water. Edible.

115. BLACK-BELLIED PLOVER. **Squatarola squatarola.**
Rather common in fall and spring and small numbers remain through the winter along the seacoast.

116. AMERICAN GOLDEN PLOVER. **Charadrius dominicus.**
Rare coastwise migrants.

117. KILLDEER. **Oxyechus vociferus.**
Common residents. Found in pairs or families. A portion of their food is insects picked up on dry ground.

118. SEMIPALMATED PLOVER. **Ægialitis semipalmata.**
Rather common coastwise migrants. Occasional at other seasons. In summer sometimes seen on fresh waters.

119. SNOWY PLOVER. **Ægialitis nivosa.**
Abundant residents on sandy beaches near the surf. Occasionally found about fresh water lakes in summer.

120. WILSON PLOVER. **Ochthodromus wilsonius.**
Rare stragglers. One taken at Pacific Beach June 27, 1894.

121. MOUNTAIN PLOVER. **Podasocys montanus.**
Rather common winter residents in open plains. Apparently does not go near water.

Family APHRIZIDÆ. Surf Birds and Turnstones.

A small family of rather small sized birds inhabiting rocky shores and islands in the sea. They are usually seen singly or in small flocks. The food is marine life found at the waters' edge, usually on or under rocks.

122. SURF BIRD. **Aphriza virgata.**
Rare migrants or winter residents. I took one at Point Loma.

123. RUDDY TURNSTONE. **Arenaria interpres morinella**
Rather common coastwise migrants.

124. TURNSTONE. **Arenaria melanocephala.**
Rather common winter residents of rocky seashores.

Family HÆMATOPIDÆ. Oyster-catchers.

A very small family of medium sized birds inhabiting rocky seashores and islands in the sea. They feed on molluscs, such as bivalves, which their knife-like bills are peculiarly adapted for opening.

125. FRAZAR OYSTER-CATCHER. **Hæmatopus frazari.**
Rare summer visitants to rocky shores along the seacoast.

126. BLACK OYSTER-CATCHER. **Hæmatopus bachmani.**
Uncommon residents of rocky seashores and islands.

Land Birds

Order GALLINÆ. Gallinaceous Birds.

An important order including such domestic poultry as chickens and turkeys. The family to which these belong (PHASANIDÆ) is not represented by native species in California.

Family TETRAONIDÆ, Grouse, Quail, etc.

A large family of considerable economic importance, as all the species are edible, and many are large enough to furnish a considerable amount of food. The family has a wide distribution, from seacoast to mountain top. Some species are found in forests; others in open country, providing brush or weeds or other cover is available in emergencies. The food is varied, including insects, seeds, leaves, etc. and is mostly gleaned from the ground. A few species feed on fruits, buds and leaves of trees, etc.

127. PLUMED QUAIL. MOUNTAIN QUAIL. **Oreortyx pictus plumiferus.**

Common residents of brushy forests in the mountains. Not migratory.

128. VALLEY QUAIL. **Lophortyx californicus vallicola.**

Abundant residents of foothills and valleys. The ranges of the Plumed and Valley Quails overlap somewhat. Not migratory. No Grouse or Pheasants are native to this county.

Order COLUMBÆ. Pigeons.

Family COLUMBIDÆ

A rather large family of medium sized birds. They are birds of strong flight, and the species found in cool climates are migratory. The food is mainly vegetable, seeds, nuts, fruits, buds and leaves. Edible.

129. BAND-TAILED PIGEON. **Columba fasciata.**

Irregular visitants, occasionally abundant. Found principally in the mountains as acorns are more abundant there. Some "off years" for acorns few or no Pigeons appear in this county. Formerly a few bred here.

130. WESTERN MOURNING DOVE. **Zenaidura macroura marginella.**

Abundant residents of the foothills and valleys. Less common in winter and probably all the individuals migrate, being insensibly replaced by new comers. Beneficial through eating so many seeds, and rarely, if ever, doing any harm.

131. WHITE-WINGED DOVE. **Melopelia asiatica trudeaui.**

Rare stragglers from Lower California. One has been taken at Escondido.

132. MEXICAN GROUND DOVE. **Chamæpelia passerina pallescens.**

Two or three stragglers from Lower California have been taken in this county.

Order RAPTORES. Birds of Prey.

Family CATHARTIDÆ. Vultures.

A family of very large birds, of general distribution, but in most cases found sparingly. The food of most species is exclusively carrion and the birds are very useful as scavengers and should be rigidly protected.

133. CALIFORNIA VULTURE. CALIFORNIA CONDOR. **Gymnogyps californianus.**

Fairly common when the country was first settled by Americans. When the sheep industry was at its height the shepherds poisoned many carcasses of dead sheep to lessen the numbers of troublesome coyotes. Vultures also ate the carcasses and were poisoned, with the result that Vultures became very scarce. Irresponsible hunters also shot every large bird that came near and this magnificent and useful Vulture was nearly exterminated. A state law now imposes a heavy penalty for killing a Vulture and under this protection the species is slowly increasing in numbers. This species should not be called a Condor, as the true Condor is a South American bird of another genus.

134. TURKEY VULTURE. TURKEY BUZZARD. **Cathartes aura septentrionalis.**

Common spring, summer and fall residents, less common in winter. Occasionally seen gathered in flocks about some carcass. Very beneficial and should never be killed.

Family FALCONIDÆ. Hawks, etc.

Mostly large, powerful birds, feeding on mammals, birds or fish killed by themselves; or insects in the case of some of the smaller or more sluggish species. A few species are injurious through capturing poultry or game birds, but the majority prey on mice or other noxious animals and should be thoroughly protected. The general practice of shooting all hawks and owls cannot be too strongly condemned. Kill no predaceous bird not positively known to be harmful.

135. WHITE-TAILED KITE. **Elanus leucurus.**

Formerly occasional residents, now very rare or completely exterminated in this county. The food is mice, lizards, snakes, grasshoppers, etc.

136. MARSH HAWK. **Circus hudsonius.**

Common residents of the valleys, where they hunt over meadows, grassy valleys and marshes. They prey on meadow mice almost exclusively.

137. SHARP-SHINNED HAWK. **Accipeter velox.**

Rather common fall, winter and spring residents. This active little Hawk is the terror of small birds, on which it principally preys, but it catches some poultry and many quail. It is able

to carry off quail or young poultry heavier than itself. It is one of the few hawks that should be killed whenever possible.

138. COOPER HAWK. **Accipeter cooperi.**

Rather common winter residents of the valleys. Occasional summer residents and breed in the mountains. Very destructive of poultry and game birds. This is the Hawk principally responsible for the bad name given all hawks. It deserves no mercy.

138a. WESTERN GOSHAWK. **Astur atricapillus striatulus.**

One shot by Rudolph Wueste at the Lower Otay Reservoir (about five miles from the Lower California line) November 9. 1916, is now in the Museum of Natural History at San Diego,

139. HARRIS HAWK. **Parabuteo unicinctus harrisi.**

Stragglers from the Colorado valley or Lower California. One shot in Mission Valley now in the Natural History Museum, others have been seen.

140. WESTERN RED-TAILED HAWK. **Buteo borealis calurus.**

Common residents throughout the county, least common in winter. Often called "Chicken Hawk" and "Hen Hawk." Occasionally a young Hawk in its first autumn will catch a chicken, but this rarely happens and after the young Hawk becomes expert in hunting it does not bother poultry, but subsists on ground squirrels, rabbits, mice and grasshoppers, and is far more beneficial than injurious.

141. RED-BELLIED HAWK. **Buteo lineatus elegans.**

Rather rare residents of the valleys, generally only in those containing willow or cottonwood groves. The food is meadow mice, frogs and insects.

142. ZONE-TAILED HAWK. **Buteo abbreviatus.**

Rare stragglers from Lower California. Several have been taken in the county.

143. SWAINSON HAWK. **Buteo swainsoni.**

Rather common summer residents of the valleys and foothills. Migrates in flocks. The food is principally grasshoppers and beetles, with some mice. Never harm poultry. Probably the most beneficial of our hawks. Should never be killed.

144. FERRUGINEOUS ROUGH-LEG HAWK. CALIFORNIA SQUIRREL HAWK. **Archibuteo ferrugineus.**

These large hawks are rather rare winter residents; formerly they were more common. They frequent open valleys and prey on ground squirrels and mice. They are highly beneficial.

145. GOLDEN EAGLE. **Aquila chrysaetos.**

Uncommon residents of foothills and mountains. Food is rabbits, squirrels and waterfowl.

146. BALD EAGLE. **Haliæetos leucocephalus.**

Rare residents of the seacoast and islands. Their food is mostly fish.

147. PRAIRIE FALCON. **Falco mexicanus.**

Rare residents of the foothills. Food mostly squirrels, rabbits, quail, etc. but occasionally poultry.

148. DUCK HAWK. **Falco peregrinus anatum.**

Rather rare residents of the seacoast and islands. Occasional inland in winter. Preys principally on waterfowl. A powerful falcon, swift of flight and bold.

149. PIGEON FALCON. PIGEON HAWK. **Falco columbarius.**

Rather common winter residents of the valleys and foothills. Their food is principally small birds.

150. RICHARDSON FALCON. **Falco richardsoni.**

Apparently about as common about San Diego as the preceding species. Habits, food and season much the same.

151. SPARROW HAWK. **Falco sparverius.**

Common residents throughout the county. This very small falcon feeds on mice, grasshoppers, beetles, etc. and is beneficial.

152. OSPREY. **Pandion haliætus canadensis.**

Rare residents of the seacoast. More common in the Santa Barbara Islands. Their food is fish.

Family ALUCONIDÆ. Barn Owls.

A sm all family of rather large owls differing in technical characters from the Strigidæ. Habits, etc. similar. Nocturnal.

153. AMERICAN BARN OWL. **Aluco pratincola.**

Common residents of the valleys and foothills. Often called "Monkey-faced Owls." They frequently inhabit barns and other buildings. They do not harm poultry and should be encourgaed to live about farm premises. The principal item of their food is gophers; they also catch many field mice. Barn Owls are the greatest friend the farmer has among birds.

Family STRIGIDÆ. Horned Owls.

A rather large family of rapacious birds. They vary in size from the large Great Horned Owls to the little bird owls the size of a sparrow. Their food varies in size also, from rabbits to beetles. With but one or two exceptions owls are beneficial and some are among the farmers' best friends. Nocturnal or crepuscular.

154. LONG-EARED OWL. **Asio wilsonius.**

Rather common residents of willow groves in the valleys and of oak forests in the foothills and lower mountains. They like rather thick cover. Their food is almost exclusively injurious rodents.

155. SHORT-EARED OWL. **Asio flammeus.**

Rather rare winter residents of open ground, such as salt marshes along the seacoast, meadows and alfalfa fields and grassy marshes inland. Hide in tufts of grass in the daytime. Often hunt on cloudy days over grass or weeds making cover for mice and gophers. Very beneficial.

156. SPOTTED OWL. **Strix occidentalis.**

Rare residents of oak forests in the foothills and pine forests up to 5,000 feet altitude. Habits but little known.

157. SOUTHERN CALIFORNIA SCREECH OWL. **Otus asio quercinus.**

Common residents of wooded localities from seacoast to high mountains. Most common in the foothills. The food is mice, beetles and other insects.

158. GREAT HORNED OWL. **Bubo virginianus pacificus.**

Common residents of all parts of the county except the open mesas. This large owl has strength enough to kill and carry away a jack rabbit or a full grown hen. They are the only owls that destroy poultry. Those living in the eastern part of the county along the border of the desert are probably of the subspecies **pallescens.**

159. BURROWING OWL. **Speotyto cunicularia hypogæa.**

Common residents in open ground from the seashore to the higher foothills. Live in burrows dug by themselves or enlarged from squirrel holes. Hunt principally at twilight. The food is grasshoppers, beetles, mice and gophers.

160. CALIFORNIA PIGMY OWL. **Glaucidium gnoma californicum.**

Rare residents of the mountains, occasionally found in the foothills. This little sparrow-sized owl feeds mainly on insects, but also catches some mice.

Order COCCYGES, Cuckoos, Trogons, Kingfishers, etc.

Family CUCULIDÆ. Cuckoos.

This family contains two distinct groups of birds, the Ground Cuckoos, and the true Cuckoos. The Ground Cuckoos are long of leg, weak of wing and catch their food on the ground. The Cuckoos are strong of flight, inhabit trees and shrubbery and catch their insect prey among the foliage. Both groups have the toes arranged alike, two in front and two behind. The Ground Cuckoos are mostly inhabitants of warm climates, one species coming north into the southwestern United States.

161. ROAD-RUNNER. **Geococcyx californianus.**

Common residents of valleys and foothills. The food is lizards, beetles, grasshoppers, snakes, mice and occasionally the eggs of other birds. They have been known to take young from the nests of other birds and eat them. They run rapidly and spend much of their time on the ground.

162. CALIFORNIA CUCKOO. **Coccyzus americanus occidentalis.**

Summer residents of willow thickets in the valleys. Apparently not very common. As they are very shy they are not often seen. Their food is insects, including a large proportion of caterpillars in season.

Family ALCIDINIDÆ. Kingfishers.

163. BELTED KINGFISHER. **Ceryle alcyon.**

Rather common residents along the seacoast. As their food is fish the Belted Kingfishers are not often seen far from the coast

in this county. The nests are placed in burrows in banks near water.

Order PICI.

Family PICIDÆ. Woodpeckers.

A large family of wide distribution. The food is varied, but with many species the principal item is wood-boring larvæ, dug from trees in more or less rotten places. Other items of food are ants, beetles and other insects, acorns and other nuts, fruits and seeds.

164. CABANIS WOODPECKER. **Dryobates villosus hyloscopus.**

Rather common residents of wooded localities throughout the county.

165. WILLOW WOODPECKER. **Dryobates pubescens turati.**

Rather rare residents of willow groves. This seems to be about the southern limit of this woodpecker.

166. NUTTALL WOODPECKER. **Dryobates nuttalli.**

Rather common residents in the foothills and lower mountains.

167. WHITE-HEADED WOODPECKER. **Xenopicus albolarvatus gravirostris.**

Rare residents of the higher mountains.

168. RED-BREASTED SAPSUCKER. **Sphyrapicus varius daggeti.**

Occasional winter residents of the foothills and mountains. These woodpeckers drill numerous small holes in the bark of trees in the latter part of the winter and drink the sap that flows from the holes, hence the name.

169. RED-NAPED SAPSUCKER. **Sphyrapicus varius nuchalis.**

Rare winter residents in the foothills.

170. CALIFORNIA WOODPECKER. **Melanerpes formicivorus bairdii.**

Abundant residents in the mountains in oak timber and mixed oak and pine forests. This is the Woodpecker that drills small holes in the bark of trees and drives an acorn in each hole in the fall. This is done to store the acorns for the purpose of eating the acorn meat in the coming winter.

171. LEWIS WOODPECKER. **Asyndesmus lewisi.**

Rather common winter residents of the foothills and mountains. Frequently catches insects on the wing like a flycatcher.

172. RED-SHAFTED FLICKER. **Colaptes cafer collaris.**

Common residents of wooded localities in the coast region and foothills and summer residents in the mountains. Eats many ants, mostly picked up on the ground.

Order MACROCHIRES. Goatsuckers, Swifts, Hummingbirds.

Family CAPRIMULGIDÆ. Goatsuckers.

A rather small family of long-winged, short-legged, medium sized birds. The food is insects caught on the wing. Nocturnal and crepuscular. Beneficial.

173. DUSKY POORWILL. **Phalænoptilus nuttalli californicus.**

Rather common summer residents of the foothills and mountains. Present in the lower valleys in winter in small numbers.

174. PACIFIC NIGHTHAWK. **Chordeiles virginianus hesperis.**

Occasional in the eastern part of the county in the migrations.

175. TEXAS NIGHTHAWK. **Chordeiles acutipennis texensis.**

Rather common summer residents of the coast region and foothills.

Family MICROPODIDÆ. Swifts.

Small swallow-like birds, and usually confused with swallows, but technically quite different. The flight is very swift. The food is insects caught on the wing. Beneficial. Nests are placed in crevices of rocks or in holes in trees; one eastern species now frequently places its nests in chimneys.

176. BLACK SWIFT. **Cypseloides niger borealis.**

Rare spring migrants.

177. VAUX SWIFT. **Chætura vauxi.**

Rather common migrant. Similar to the eastern Chimney Swift.

178. WHITE-THROATED SWIFT. **Aeronautes melanoleucus.**

Summer residents, common locally. Present irregularly in winter. Nests in steep cliffs.

Family TROCHILIDÆ. Hummingbirds.

A large family (over 400 species), exclusively American in distribution, and mainly tropical. The smallest known birds are hummingbirds and the largest species are not as large as ordinary sparrows. The food is mostly minute insects, frequently taken from tubular flowers, many species add honey also. The nests are beautiful, warm, thick-walled, often outwardly stuccoed with bits of lichens. The eggs are plain white, two in a set. Some species are quarrelsome and all are fearless. Most species have a variety of notes and some have a low sweet song.

179. BLACK-CHINNED HUMMINGBIRD. **Archilochus alexandri.**

Common summer residents from the coast to the lower edge of the pine forests.

180. COSTA HUMMINGBIRD. **Calypte costæ.**

Common summer residents. Nest preferably on hillsides. A few winter in the foothills at the edge of the Colorado Desert.

181. ANNA HUMMINGBIRD. **Calypte anna.**

Common winter residents from the sea to the foothills, and present in fall and spring in smaller numbers. After the breeding season in the coast region many migrate to the mountains, remaining there to the end of the season of bloom of flowers.

182. RUFOUS HUMMINGBIRD. **Selasphorus rufus.**

Common spring migrants in the coast region and common late summer and fall migrants in the mountains. None breed here. I took a nest and two eggs in Alaska in June. Quarrelsome, even driving hawks away.

183. ALLEN HUMMINGBIRD. **Selasphorus alleni.**

Rather common spring migrants in the coast region. Common fall migrants in the mountains. Residents in the Santa Barbara Islands.

184. CALLIOPE HUMMINGBIRD. **Stellula calliope.**

Rather common spring migrants through the foothills. Our smallest hummingbird.

Order PASSERES. Perching Birds.

The largest order of birds, containing many families of medium or small sized birds.

Family TYRANNIDÆ. Flycatchers.

A large family of wide distribution. The Flycatchers are of small size. Their food is insects, mostly caught in flight. Some of the species frequent shrubbery; others occur in forests, or in more or less open country where they can watch for passing insects from some perch. All are beneficial, with the exception of certain species that catch honey bees at times.

185. WESTERN KINGBIRD. **Tyrannus verticalis.**

Common summer residents except in the higher mountains. Eats drone bees occasionally.

186. CASSIN KINGBIRD. **Tyrannus vociferans.**

Rather rare residents of the coast region.

187. ASH-THROATED FLYCATCHER. **Myiarchus cinerascens.**

Rather common summer residents of the foothills and lower mountains. Occasional in the coast region. Nests in knotholes in trees.

188. SAY PHŒBE. **Sayornis sayus.**

Common winter residents of the coast region, rare summer residents there but more common in the lower mountains, particularly on the desert slope. Nests are built on ledges of rock walls in canons, usually but a few feet from the bottom.

189. BLACK PHŒBE. **Sayornis nigricans.**

Common residents from the sea to the pine forests. Most often found near water. The nests, made principally of mud, are placed under bridges, on beams in barns, etc.

190. OLIVE-SIDED FLYCATCHER. **Nuttalornis borealis.**

Summer residents of high mountains. Rare in this county be-

cause of lack of suitable conditions, which are present here only on the summits of Cuyamaca and Palomar. The nests are usually placed on the upper branches of fir trees.

191. WESTERN WOOD PEEWEE. **Myiochanes richardsoni.**

Common summer residents of canons and forests. Migrates through the coast region. Eats bees to some extent.

192. WESTERN FLYCATCHER. **Empidonax difficilis.**

Rather common summer residents of the forests and canons of the foothills and mountains. Migrates through the coast regions.

193. TRAILL FLYCATCHER. **Empidonax trailli.**

Generally distributed in the migrations. Rather common residents of willow thickets, principally in the lower valleys.

194. HAMMOND FLYCATCHER. **Empidonax hammondi.**

Rather common migrants in the spring through the lower part of the county, in the fall through the mountains also.

195. WRIGHT FLYCATCHER. **Empidonax wrighti.**

Rather common migrants in the foothills and mountains and breed in small numbers in the higher mountains.

196. VERMILLION FLYCATCHER. **Pyrocephalus rubineus mexicanus.**

Rare winter stragglers from the Colorado valley.

Family ALAUDIDÆ. Larks.

A small family of small birds, widely distributed in the north temperate and arctic zones. They are represented in America by the introduced skylark and one native genus. The food is insects. They are mostly ground dwellers. Beneficial.

197. CALIFORNIA HORNED LARK. **Otocoris alpestris actia.**

Abundant residents of valleys and plains. They run about on the ground picking up insects and are often seen in the roads. The nests are placed on the ground under weeds or grass. They frequently sing while fluttering high in the air like a skylark.

198. MOHAVE HORNED LARK. **Otocoris alpestris ammophila.**

Winter residents of mountain valleys, usually in flocks mixed with the preceding subspecies.

Family CORVIDÆ. Crows, Jays and Magpies.

A rather large-sized family of wide distribution. The birds are of medium or rather large size. They perch on trees or walk or hop around on the ground as occasion arises in hunting for food. The food is almost anything eatable either animal or vegetable. Some of the species are beneficial but the balance in general turns the other way.

199. BLUE-FRONTED JAY. **Cyanocitta stellari frontalis.**

Common residents of the pine forests, occasionally descending in winter to the oak forests. Usually seen in companies of half a dozen or so. Noisy. Wary.

200. CALIFORNIA JAY **Aphelocoma californica.**

Common residents of wooded localities from the coast to the lower edges of the pines. Sometimes troublesome about farm yards near brush by eating hens' eggs. Sometimes eat the eggs and young from the nests of other birds.

201. RAVEN. **Corvus corax sinuatus.**

Generally distributed through the county in open ground. Now not often seen in the more thickly settled parts of the county.

202. WESTERN CROW. **Corvus brachyrhynchos hesperis.**

Rather common residents, but local. They nest in willow groves and are more often seen near willows all the year. They do not seem to pull up young corn much in this county, and generally do more good than harm.

203. CLARKE NUTCRACKER. **Nucifraga columbiana.**

Transient winter visitants to the eastern slope of the mountains.

204. PINON JAY. **Cyanocephalus cyanocephalus.**

Irregular winter visitants in the pinon and juniper groves on the desert slopes of the mountains. Go in flocks, sometimes of considerable size.

205. NEVADA COWBIRD. **Molothrus ater artemesiæ.**

Stragglers or rare migrants in the desert along the eastern edge of the county.

Family ICTERIDÆ. Troupials, Orioles.

A large family, peculiar to America, and most abundant in South America. Some species are arboreal, others are terrestrial and some inhabit reeds and tules in swamps. The habits are quite varied, as also is the food and the quality of the song.

206. DWARF COWBIRD. **Molothrus ater obscurus.**

Rare stragglers. Have been taken at San Diego.

207. YELLOW-HEADED BLACKBIRD. **Xanthocephalus xanthocephalus.**

Common migrants and breed in small colonies in tule marshes. Occasional elsewhere.

208. SAN DIEGO REDWING BLACKBIRD. **Ægelaius phœniceus neutralis.**

Abundant migrants. Common summer residents in tule marshes. Irregularly common locally in winter. Sometimes destructive of grain crops, but beneficial at other times.

209. TRICOLOR BLACKBIRD. **Ægelaius tricolor.**

Formerly abundant winter residents and locally common summer residents of tule marshes. Now less common. More abundant north in the San Joaquin Valley. Habits similar to those of the preceding species.

210. WESTERN MEADOWLARK. **Sturnella neglecta.**

Abundant winter residents and common summer residents of valleys throughout the county. While the species is present throughout the year the winter residents go north in spring and are replaced by others coming from Mexico. Fine songsters. Not true larks, which belong in another family.

211. SCOTT ORIOLE. **Icterus parisorum.**

Rather common spring migrants in the eastern part of the county and probably breed there in the foothills at the edge of the desert. Rare summer residents at San Diego. Have a sweet song.

212. ARIZONA HOODED ORIOLE. **Icterus cucullatus nelsoni.**

Common summer residents from the seacoast to about 3,000 feet altitude. Preferably nest in palm trees.

213. BULLOCK ORIOLE. **Icturus bullocki.**

Common residents of all wooded localities from the seacoast up to the pine forests.

214. BREWER BLACKBIRD. **Euphagus cyanocephalus.**

Abundant residents in most of the valleys of the county. Often seen in parks and on lawns in the city.

Family FRINGILLIDÆ. Sparrows.

This is the largest and best known family of birds. Of world wide distribution, and occur in all kinds of localities except on water, in fact, wherever seeds may be found. The food is seeds, buds, leaves and fruit, with more or less insects added by many species. An occasional species does some harm to fruit or grain at times, but many species are beneficial in eating quantities of weed seeds. Most species have a pleasant song. Some species are ground dwellers; others live in trees; many inhabit shrubs. In fact any kind of location furnishing sufficient food may have its peculiar species of sparrow inhabitant.

215. CALIFORNIA PURPLE FINCH. **Carpodacus purpureus californicus.**

Rather rare summer residents of pine forests. Irregular winter residents of the valleys and mesas.

216. HOUSE FINCH. "LINNET." **Carpodacus mexicanus frontalis.**

Abundant residents throughout the county. Sometimes destroys peaches and other fruits and grain.

217. WILLOW GOLDFINCH. **Astragalinus tristis salicamans.**

Rather common residents of the valleys; in summer principally found around willow thickets.

218. GREEN-BACKED GOLDFINCH. **Astragalinus psaltria hesperophila.**

Common residents. In summer most common in valleys in the foothills, in winter generally distributed but most plentiful in the lower valleys and mesas.

219. LAWRENCE GOLDFINCH. **Astragalinus lawrencei.**

Rather common summer residents of the foothills and mountains. Irregular winter visitants. Some winters none are seen.

220. PINE SISKIN. PINE LINNET. **Spinus pinus.**

Rather common spring migrants in wooded regions. May breed in the highest mountains, but I know of no breeding record for the county.

221. ENGLISH SPARROW. **Passer domesticus.**

Though common in other cities this pest has appeared in San Diego in but small numbers yet, and if persistently hunted it can be kept in check.

222. ALASKA LONGSPUR. **Calcarius lapponicus alascensis.**

One shot by me near Mission Bay, Oct. 2, 1909. But one other record for the state.

223. WESTERN VESPER SPARROW. **Pooecetes gramineus affinis.**

Rather common winter residents in the valleys.

224. WESTERN SAVANNA SPARROW. **Passerculus sandwichensis alaudinus.**

Common winter residents in the valleys. Likes grassy localities.

225. BELDING MARSH SPARROW. **Passerculus beldingi.**

Abundant residents of the salt marshes.

226. LARGE-BILLED MARSH SPARROW. **Passerculus rostratus.**

Common fall and winter residents along the seacoast. Frequents wharves, lumber yards and similar places along the water front and sea beach. Breeding locality unknown, probably further south.

227. WESTERN GRASSHOPPER SPARROW. **Ammodramus savannarum bimaculatus.**

Irregular residents of grassy valleys, seldom common. They may be absent from a locality one year where they may be found other years. Summer residents migrate and are replaced by others in the warmer valleys and mesas.

228. WESTERN LARK SPARROW. **Chondestes grammacus strigatus.**

Common residents of mesas and foothills and breed up to the pines. Frequent orchards and vineyards, Beneficial.

229. WHITE-CROWNED SPARROW. **Zonotrichia leucophrys.**

Rather common spring migrants through the mountains.

230. INTERMEDIATE SPARROW. **Zonotrichia leucophrys gambeli.**

Abundant winter residents from the seacoast to the pine region. Frequently damages gardens, but seldom troublesome in grain fields.

231. GOLDEN-CROWNED SPARROW. **Zonotrichia coronata.**

Rather common winter residents in brush from the seacoast to the lower mountains.

232. WESTERN CHIPPING SPARROW. **Spizella passerina arizonæ.**

Rather common summer residents and occasional in winter.

233. BREWER SPARROW. **Spizella breweri.**

Rather common migrant along the eastern slope of the mountains and a few breed there. Occasional winter residents near the seacoast.

234. BLACK-CHINNED SPARROW. **Spizella atrogularis.**
Infrequent summer residents of brushy localities in the foothills and lower mountains.
236. SLATE-COLORED JUNCO. **Junco hyemalis.**
Casual in winter.
237. THURBUR JUNCO. **Junco oreganus thurburi.**
Abundant winter residents of the foothills and lower mountains, and more or less common in the coast region. Rare summer residents of the higher mountains, where a few breed.
238. DESERT BLACK-THROATED SPARROW. **Amphispiza bilineata deserticola.**
Common spring migrants through the foothills bordering the desert. A few breed there.
239. BELL SPARROW. **Amphispiza belli.**
Rather common summer residents of brush-covered mesas from the coast to the foothills and occasional in winter.
240. NEVADA SAGE SPARROW. **Amphispiza nevadensis**
241. CALIFORNIA SAGE SPARROW. **Amphispiza nevadensis canescens.**
Rather common winter residents of brushy localities in mesas and foothills of both sides of the mountains.
242. RUFOUS-CROWNED SPARROW. **Aimophila ruficeps.**
Rather common local residents of higher mesas and foothills.
243. SAN DIEGO SONG SPARROW. **Melospiza melodia cooperi.**
Common residents of tule patches and mixtures of weeds and brush in wet places in the lower country and summer residents of the mountains.
244. LINCOLN SPARROW. **Melospiza lincolni.**
Rather common winter residents of the valleys. Prefers damp localities.
245. FORBUSH SPARROW. **Melospiza lincolni gracilis.**
Occasional winter residents of the valleys.
246. SHUMAGIN FOX SPARROW. **Passerella iliaca unalaschcensis.**
247. YAKATUT FOX SPARROW. **Passerella iliaca meruloides.**
Occasional in winter in the mountains.
248. SAN DIEGO TOWHEE. **Pipilo maculatus megalonyx.**
Common residents of thick brush from the seacoast to the mountains and part way down the eastern slope.
249. ANTHONY TOWHEE. **Pipilo crissalis senicula.**
Abundant residents of brush from the seacoast to the higher mountains.
250. GREEN-TAILED TOWHEE. **Oreospiza chlorura.**
Rather common migrants through the mountains.
251. PACIFIC BLACK-HEADED GROSBEAK. **Zamelodia melanocephala capitalis.**
Common summer residents of the foothills and mountains. Do some damage to fruit in small orchards situated near timber.

252. CALIFORNIA BLUE GROSBEAK. **Guiraca caerulea salicarius.**

Rather common summer residents of valleys in the foothills.

253. LARK BUNTING. **Calmospiza melanocorys.**

Casual spring migrants in the coast region. Usually migrate in flocks.

Family TANGARIDÆ. Tanagers.

A family of rather small birds confined to America and most numerous in the tropics. The males are brightly colored but the females are comparatively plain. The food is insects and fruit.

254. WESTERN TANAGER. **Piranga ludoviciana.**

Common, but irregular, spring migrants throughout the county. Rare summer residents in the highest mountains. Occasionally the migrating birds do considerable damage to cherry crops.

Family HIRUNDINIDÆ. Swallows.

A rather large family of small birds, cosmopolitan in distribution. The food is exclusively insects, caught while on the wing. Very few remain in temperate climates through the winter. Very beneficial.

255. WESTERN MARTIN. **Progne subis hesperia.**

Infrequent or irregular summer residents of timbered localities.

256. CLIFF SWALLOW. **Petrochelidon lunifrons.**

Common to abundant summer residents of suitable localities throughout the county.

257. BARN SWALLOW. **Hirundo erythrogaster.**

Infrequent summer residents along the seacoast.

258. TREE SWALLOW. **Iridoprocne bicolor.**

Rather common migrants. Infrequent summer residents of the coast region.

259. NORTHERN VIOLET-GREEN SWALLOW. **Tachycineta thalassina lepida.**

Common migrants. Breed in small numbers in the mountains in knot holes of trees.

260. BANK SWALLOW. **Riparia riparia.**

Rather common migrants.

261. ROUGH-WING SWALLOW. **Stelgidopteryx serripennis.**

Rather common migrants and breed in small numbers in the coast region.

Family BOMBYCILLIDÆ. Waxwings.

A small family inhabiting the temperate and arctic zones of the northern hemisphere. They are small birds, frequenting trees and shrubbery. The food is soft fruits and insects. Occasionally they eat cultivated fruits. Songless.

262. CEDER WAXWING. **Bombycilla cedrorum.**

Irregular winter residents. Occasionally appear in considerable numbers.

Family PTILOGONATIDÆ. The Silky Flycatchers.

A small family inhabiting Central America and Mexico, with one species in the United States. Their food is insects and berries.

263. PHAINOPEPLA. **Phainopepla nitens.**

Rather common summer residents and occasionally seen in winter. Their food is insects and such fruits as pepper tree berries and mistletoe berries. Not known to eat cultivated fruits. The insects are caught flycatcher fashion.

Family LANIIDÆ. Shrikes.

A rather small family restricted to the northern hemisphere and represented in America by but two species. The food is large insects, small mammals, reptiles, etc.

264. WHITE-RUMPED SHRIKE. **Lanius ludovicianus excubitoroides.**

Rather common residents of the eastern slope of the mountains.

265. CALIFORNIA SHRIKE. **Lanius ludovicianus gambeli.**

Common residents from the seacoast to the higher mountains. Tyrannical toward other birds and sometimes in winter catch and eat small birds such as the Intermediate Sparrow. The greater part of the food is insects, such as Jerusalem crickets and grasshoppers; but lizards and small mammals are also eaten. On the whole Shrikes are more beneficial than injurious. A peculiar habit is that of impaling prey not immediately eaten, on thorns, probably in storage, but not often utilized, fresh food being preferred.

Family VIREONIDÆ. Vireos.

A family of small birds inhabiting temperate and tropical America. They frequent shrubs and trees, and feed mainly on insects; one species takes nothing else. The song is usually short but pleasant.

266. RED-EYED VIREO. **Vireosylva olivacea.**

Casual. One specimen has been taken here.

267. WESTERN WARBLING VIREO. **Vireosylva gilva swainsoni.**

Common summer residents in the mountains and common in the migrations in the coast region. Nests in oak forests.

268. CASSIN VIREO. **Lanivireo solitarius cassini.**

Generally distributed in the migrations. Rather common summer residents of timbered canons in the mountains.

269. HUTTON VIREO. **Vireo huttoni.**

Infrequent winter residents and occasional in summer.

270. LEAST VIREO. **Vireo belli pusillus.**

Common summer residents of willow thickets.

271. GRAY VIREO. **Vireo vicinior.**

Summer residents of thick brush on mountain sides. Local in distribution, occasionally rather common.

Family MNIOTILTIDÆ. Wood Warblers.

This large family is American in distribution. The greater

number are of quite small size. Most of the species are arboreal, but a few are more or less terrestrial. The food is insects, picked from the leaves, branches, or bark of trees; occasionally caught in the air, flycatcher-like; sometimes picked up on the ground. Some species are good songsters, but the majority are rather poor singers. Most of our species migrate long distances. All the Warblers are beneficial birds and some species are particularly useful.

272. CALAVERAS WARBLER. **Vermivora ruficapilla gutteralis.**

Rather common migrants, principally through the mountains.

273. LUTESCENT WARBLER. **Vermivora celata lutescens.**

Abundant migrants throughout the county.

274. DUSKY WARBLER. **Vermivora celata sordida.**

Rather common winter residents along the seacoast. A few breed in thick brush within a mile or two of the sea. The summer home of this subspecies is the Coronado and Santa Barbara Islands and their migrations are very short for Warblers.

275. ALASKA YELLOW WARBLER. **Dendroica æstiva rubiginosa.**

Infrequent migrants through the mountains.

276. CALIFORNIA YELLOW WARBLER. **Dendroica æstiva brewsteri.**

Rather common summer residents in the foothills and mountains, and common migrants throughout the county.

277. AUDUBON WARBLER. **Dendroica auduboni.**

Abundant winter residents in the lower part of the county. Probably a few breed in the highest mountains. The food is insects, with a small proportion of weed seeds. Very beneficial because of the large proportion of injurious insects eaten.

275. BLACK-THROATED GRAY WARBLER. **Dendroica nigrescens.**

Common migrants through the mountains.

279. TOWNSEND WARBLER. **Dendroica townsendi.**

Rather common migrants through the mountains.

280. ALASKA WATER THRUSH. **Seiurus noveboracensis notabilis.**

Rare fall migrants. One has been taken at National City and another at San Diego.

281. MACGILLIVRAY WARBLER. **Oporornis tolmei.**

Rather common migrants, principally through the mountains.

282. WESTERN YELLOWTHROAT. **Geothlypis trichas occidentalis,**

Rather common migrants.

283. TULE YELLOWTHROAT. **Geothlypis trichas scirpicola.**

Rather common residents of tule marshes and wet places overgrown with weeds and brush.

284. LONG-TAILED CHAT. **Icteria virens longicauda.**

Rather common summer residents of willow thickets.

285. ALASKA PILEOLATED WARBLER.
Wilsonia pusilla pileolata.
Rather common migrants.
286. GOLDEN PILEOLATED WARBLER.
Wilsonia pileolata chryseola.
Common migrants. Breeds in small numbers in oak forests and in willow groves.

Family MOTACILLIDÆ. Wagtails.

A rather large family, principally European and Asiatic. Terrestrial, insectivorous, migratory and more or less gregarious. Most of the species have the habit of wagging their tails up and down as if balancing on uncertain footing.
287. AMERICAN PIPIT. TITLARK. **Anthus rubescens.**
Common winter residents from the seacoast to the foothills.

Family CINCLIDÆ. Dippers.

This is a small family of birds of peculiar habits for birds of this order, (**Passeres**) being exceptionally expert divers and obtaining their food under water. The family occurs in mountainous regions in northern Europe, northern Asia, western North America and western South America. They live along mountain streams and feed on aquatic insects and fish spawn. Their feet are not webbed but they fly through the water much as in flight in air. The food is picked from the gravel and stones in the beds of the streams.
288. AMERICAN DIPPER. WATER OUZEL. **Cinclus mexicanus unicolor.**
Rather rare migrants through the mountains or casual winter visitors. The lack of suitable permanent streams prevents the residence of this species in this country. They are more or less common in the mountain streams further north in this state.

Family MIMIDÆ. Mockers and Thrashers.

A moderate sized family peculiar to America. They are medium sized or rather small birds. Nearly all the species are fine songsters. Several species are excellent mimics of the songs of other birds. The food is insects and fruits.
289. SAGE THRASHER. MOUNTAIN MOCKINGBIRD.
Oroscoptes montanus.
Infrequent migrants through the coast region, but more common migrants in the eastern part of the county. Casual winter residents in the coast region.
290. WESTERN MOCKINGBIRD. **Mimus polyglottos leucopterus.**
Common residents from the seacoast to the foothills. Occasional in the lower mountains. Partial to orchards, parks and the suburbs of towns. The food is insects, berries and seeds They are fond of blackberries and figs, and are sometimes troublesome where these fruits are ripening. They eat weed seeds, elder-

berries and the pulpy seeds of poison oaks also. They eat many grasshoppers and other injurious insects. Probably the beneficial items of food overbalance the injurious ones. Their songs are partly composed of imitations of the songs of other birds, but a considerable part is their own, which is so varied that most people think it is also mimetic.

291. PASADENA THRASHER. **Toxostoma redivivum pasadenense.**

Common residents of brushy localities from the seacoast to the pine region. The food is insects and seeds in about equal quantities. Occasionally where a vineyard is bordered by brushland the birds come in from the brush and eat some grapes. They are fine singers, but do not imitate other birds.

292. LECONTE THRASHER. **Toxostoma lecontei.**

Rare or infrequent residents of the desert and foothills of the eastern part of the county. Taken by me in the San Felipe Valley ten miles east of Julian.

Family TROGLODYTIDÆ. Wrens.

A large family of small birds of world wide distribution, but most abundant in the American tropics. They are found in a variety of localities, such as thick underbrush in forests, shrubbery, tulle swamps, cactus patches, etc. The food is principally insects. The species found in cool climates are migratory. Many species are fine singers. Beneficial.

293. NORTHERN CACTUS WREN. **Heleodytes brunneicapillus couesi.**

Rather common locally in cactus thickets in the eastern part of the county.

294. BRYANT CACTUS WREN. **Heleodytes brunneicapillus bryanti.**

A considerable proportion of the Cactus Wrens living in the region from the seacoast to the foothills are **bryanti**. Others are **couesi**, while some are probably intermediates; material is lacking for positive determination. Formerly Cactus Wrens were abundant in the "cholla" cactuses, but persistent egg collecting by boys has nearly exterminated them. The big nests in the cactuses were too easily found.

295. ROCK WREN. **Salpinctes obsoletus.**

Common summer residents of canons and rocky hillsides throughout the county. Occasional in winter.

296. DOTTED CANON WREN. **Catherpes mexicanus punctulatus.**

Rather common residents of rocky hillsides and canons in the foothill region. Sweet singers. Fearless and occasionally enter open windows.

297. SAN DIEGO WREN. **Thryomanes bewicki charienturus.**

Common residents of brushy localities. In winter they come down from the higher mountains, and in summer most of them leave the coast region.

298. WESTERN HOUSE WREN. **Troglodytes ædon parkmanni.**

Common summer residents of the foothills and mountains. A few winter in the coast region.

299. TULE WREN. **Telmatodytes palustris paludicola.**

Rather common residents on tule swamps.

Family CERTHIDÆ. Creepers.

This is a small family living in the cooler parts of the northern hemisphere. They are restless little birds, found in forests, where they creep over the trunks of trees, picking insects from the crevices of the bark. Scarcely migratory.

300. SIERRA CREEPER. **Certhia familiaris zelotes.**

Infrequent residents of the coniferous forests of the higher mountains.

Family SITTIDÆ. Nuthatches.

A small family of wide distribution. The birds are small, active, expert climbers, running over the trunks and limbs of trees frequently head downward (which no other birds do habitually), searching the crevices in the bark for insects. They feed to some extent on seeds and nuts which they stick in cracks in the bark and hammer until broken, hence the name "Nuthatches," (nuthack).

301. SLENDER-BILLED NUTHATCH. **Sitta carolinensis aculeata.**

Common residents of coniferous forests, coming lower down in winter.

302. PYGMY NUTHATCH. **Sitta pygmaea.**

Common residents of coniferous forests. Occasional in the foothills in winter. Usually seen in small flocks.

Family PARIDÆ. Titmice and Chickadees.

A rather large family inhabiting the northern hemisphere, most abundant in Europe and Asia. They are hardy birds and migrate but little. Usually seen in small flocks.

303. SAN DIEGO TITMOUSE. **Bæophilus inornatus murinus.**

Rather common residents of forests in the foothills and mountains. Not as gregarious as most members of this family. These Titmice eat some fruit, mostly fruit left on the trees in fall and winter, but they also eat many scale insects.

304. MOUNTAIN CHICKADEE. **Penthestes gambeli baileyæ.**

Rather common residents of coniferous forests, some descending to the oaks in winter.

305. LEAST BUSH-TIT. **Psaltriparus mimimus.**

Common residents of brushy localities from the seacoast to the pines. Usually seen in small flocks of half a dozen to a dozen. The nest is purse-shaped and large for so very small a bird.

306. VERDIN. **Auriparus flaviceps.**
Infrequent residents of mesquit thickets on the eastern slope of the mountains.

Family CHAMÆIDÆ. Wren-tits.

Probably the smallest family of birds, as it contains but one species, including several subspecies. The distribution is the seacoast and western slope of the mountains from northern Lower California to southern Oregon, a strip of country about 800 miles long by 10 to 100 wide.

307. PALLID WREN-TIT. **Chamæa fasciata henshawi.**
Common residents of chemisal and other brush thickets. Shy and difficult to see. The food is seeds and insects.

Family SYLVIIDÆ. Warblers, Kinglets, Gnatcatchers, etc.

A large heterogenous family most numerous in Europe and Asia. The birds are all small, those members of the family found here being scarcely larger than hummingbirds. The food is insects.

308. WESTERN RUBY-CROWNED KINGLET. **Regulus calendula cineraceus.**
Rather common winter residents of forests and groves. Rare summer residents of the highest mountains. The song is loud for so small a bird.

309. WESTERN GNATCATCHER. **Polioptila cærulea obscurus.**
Common summer residents of brush and forests in the foothills and mountains and common in winter in the lower country. The food is insects, mostly small species.

310. BLACK-TAILED GNATCATCHER. **Polioptila californica.**
Rather common local residents of brush from the seacoast to the foothills. Rare winter residents.

311. PLUMBEOUS GNATCATCHER. **Polioptila plumbea.**
Infrequent winter residents of the eastern slope of the mountains.

Family TURDIDÆ. Thrushes, etc.

A large cosmopolitan family of rather small birds. The species living in summer in cool climates migrate, usually in loose flocks. The food is varied and includes insects, seeds and fruit. Many species are good singers.

312. TOWNSEND SOLITAIRE. **Myadestes townsendi.**
Infrequent migrants and rare winter residents.

313. RUSSET-BACKED THRUSH. **Hylocichla ustulata.**
Rather common summer residents of brush along streams and in wet places in the foothills.

314. ALASKA HERMIT THRUSH. **Hylocichla guttata.**
Common winter residents in brush from the seacoast to the foothills.

315. MONTEREY HERMIT THRUSH. **Hylocichla guttata slevini.**

Infrequent winter residents in brush in the coast region. Rare migrants in the mountains.

316. SIERRA HERMIT THRUSH. **Hylocichla guttata sequoiensis.**

Rare winter residents in the mountains and infrequent migrants.

317. WESTERN ROBIN. **Planesticus migratorius propinquus.**

Irregular late winter visitants, sometimes abundant, but more often fail to get this far south.

318. NORTHERN VARIED THRUSH. **Ixoreus nævius meruloides.**

Occasional winter visitants, sometimes in numbers, to the coast region.

319. WESTERN BLUEBIRD. **Sialia mexicanus occidentalis.**

Common winter residents. A few breed in the mountains.

320. MOUNTAIN BLUEBIRD. **Sialia curracoides.**

Rather common winter residents on the mesas from the coast to the foothills.

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By FRANK STEPHENS

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Order Cetacea

Cetaceans are mammals that are fishlike in form and adapted for life in oceans, seas and large rivers. Like all mammals they breathe by means of lungs and suckle their young, which are born well developed.

Family BALÆNIDÆ. Whalebone Whales.

The food is zoophytes, mollusks, crustaceans and small fish. When a quantity of these are taken into the mouth the accompanying water is strained out through the fringed "balleen" of the upper jaw, the mouth being partially closed. Whales of this family have no teeth.

1. CALIFORNIA GRAY WHALE. **Rhachianectes glaucus.**
Formerly common, now infrequent or nearly extinct. Migrate up and down the coast, at times within sight from the land. Seen here from November until April. Hunted for their oil, which averages about twenty barrels to the whale. The flesh is beginning to be utilized for food.
2. PACIFIC HUMPBACK WHALE. **Megaptera versabilis.**
Nearly exterminated. Migrate irregularly.
3. SULPHUR-BOTTOMED WHALE. **Sibbaldius sulfureus.**
The largest species of whale. Swift and difficult to capture. Not common. Migrate irregularly.
4. PACIFIC FINBACK WHALE. **Balænoptera velifera.**
Occasional along the coast.

Family PHYSETERIDÆ. Sperm Whales.

The food is squid, cuttlefish, octopus, etc. Teeth in lower jaw.

5. SPERM WHALE. **Physeter macrocephalus.**
Found in temperate and tropical seas. Now almost exterminated.

Family DELPHINIDÆ. Dolphins, Porpoises, etc.

The food is fish, squid, cuttlefish, etc. Gregarious and voracious. But little is known about the habits of these small cetaceans. Usually there are teeth in both jaws.

6. NORTHERN RIGHT WHALE PORPOISE. **Lissodelphis borealis.**

Rather common. Sometimes enter bays.

7. BAY PORPOISE. **Phocæna communis.**

The Bay Porpoises seem to prefer brackish waters, where rivers enter the ocean and therefore are not common here.

8. BLACKFISH. **Globicephala scammoni.**

Formerly common off the coast; now this large porpoise is seldom seen.

9. GRAMPUS. **Grampus griseus.**

10. COWFISH. **Tursiops gilli.**

Occasional along the coast. Said to have entered bays formerly.

11. STRIPED PORPOISE. Striped Dolphin. **Lagenorhynchus obliquidens.**

Rather common near the coast and occasional in bays.

12. COMMON DOLPHIN. **Delphinus delphis.**

Rather common near the coast and occasional in bays.

Order UNGULATA.

Family CERVIDÆ. Deer.

But one native species of this family occurs in this county now. It is possible that elk may have once ranged this far south but I know of no records of their occurrence here.

13. CALIFORNIA MULE DEER. **Odocoileus hemionus californicus.**

Still fairly common in the mountains. If the laws regarding close seasons and number limits are honestly obeyed there will always be fair deer hunting in this county, as there is a large area of brush land and forest that will never be put in cultivation and will be good deer range.

Several Dwarf Elk have been turned out in the Laguna Game Preserve, but they may not be able to establish themselves.

Family ANTILOCAPRIDÆ. Prong-horn Antelopes.

14. PENINSULA PRONG-HORN ANTELOPE. **Antilocapra americana peninsularis.**

Now practically extinct in this county. Not long ago they ranged along the edge of the Colorado Desert in the eastern part of this county. Many years ago I saw four at Carrizo Creek. I have heard that when the first settlers came to this county Antelopes were found on the mesas near the seacoast.

Family BOVIDÆ. Cattle, Sheep, etc.

15. NELSON BIGHORN. Mountain Sheep. **Ovis canadensis nelsoni.**

While not as common as they were twenty years ago Bighorns are still to be found on the mountain sides of the desert slope, and now appear to be slowly increasing in numbers.

Order RODENTIA. Gnawing Animals.

Family SCIURIDÆ. Squirrels.

This is a large family of rather small-sized animals. Squirrels are found in nearly all parts of the world except Australia. Some species are used for food. Some species are of economic importance because of their destruction of crops. The habits are varied; some are arboreal, others are terrestrial; many are fossorial. Most species are diurnal, but the Flying Squirrels are principally nocturnal. The principal food is vegetable,—seeds, fruits, leaves, etc., but some flesh and insects are eaten by many species.

16. FISHERS GROUND SQUIRREL. **Citellus beecheyi fisheri.**

Abundant in the mountains and west to the sea. Not found in the desert or in the foothills bordering the desert. Very destructive to crops and pasturage. Has been found to be infested with the germs of bubonic plague in other counties of this state. Has few redeeming characters.

17. ROUND-TAILED GROUND SQUIRREL. **Citellus tereticaudus.**

Rather common along the edge of the Colorado Desert and in the valleys of the eastern slope of the mountains.

18. ANTELOPE GROUND SQUIRREL. **Ammospermophilus leucurus.**

Common on the eastern slope of the mountains. Prefers rocky ground around the edges of the valleys.

19. MERRIAM CHIPMUNK. **Eutamias merriami.**

Found principally in forests of mixed oak and pine. Common in a few places.

20. ANTHONY GRAY SQUIRREL. **Sciurus griseus anthonyi.**

Found in mixed oak and pine forests on the Laguna, Cuyamaca and Palomar Mountains. They are subject to epidemics and irregular fluctuations in abundance.

I am told that Flying Squirrels have been seen on Palomar Mountain, but I have seen none in the county.

Family MURIDÆ. Rats and Mice.

A very large family of world wide distribution. The introduced species are destructive and harmful, as are a few of the native species in a less degree. The greater number of native species occur mostly at a distance from dwellings and cultivated land and therefore are not of economic importance. Some species are almost exclusively vegetarian, others, particularly the introduced species, are omnivorous.

21. BROWN RAT. **Epimys norvegicus.**

Introduced and thoroughly established. Abundant in towns and becoming common in the country. Very destructive. Sometimes carry disease germs into dwellings.

22. BLACK RAT. **Epimys rattus.**
Earliest in introduction, but kept reduced in numbers by the stronger Brown Rat.

23. ROOF RAT. **Epimys rattus alexandrinus.**
Introduced. Has not become numerous.

24. HOUSE MOUSE. **Mus musculus.**
Introduced. Abundant.

25. GRASSHOPPER MOUSE. **Onychomys torridus.**
Found in valleys on the eastern slope of the mountains, but nowhere common.

26. RAMONA GRASSHOPPER MOUSE. **Onychomys torridus ramona.**
Found on the mesas and in valleys of the coast region. Not common. Food is insects with some flesh and seeds.

27 GAMBEL WHITE-FOOTED MOUSE. **Peromyscus maniculatus gambeli.**
Common throughout the county. Most abundant in the pine forests. Not often troublesome in dwellings.

28. SONORA WHITE-FOOTED MOUSE. **Peromyscus maniculatus sonoriensis.**
The paler desert form. Common in the eastern part of the county.

29. ROWLEY MOUSE. **Peromyscus boylii rowleyi.**
A mountain species. Common locally.

30. SAN PEDRO MARTIR MOUSE. **Peromyscus truei martirensis.**
Found in the foothills and mountains. Seldom common.

31. CHEMISAL MOUSE. **Peromyscus californicus insignis.**
Found in thick brush from the lower edge of the pine forests to the sea. Common.

32. DESERT MOUSE. Hermit Mouse. **Peromyscus eremicus.**
Abundant in parts of the Colorado Desert and on the eastern slope of the mountains, principally in valleys.

32a. DULZURA MOUSE. **Peromyscus eremicus fraterculus.**
Rather common in brushy localities from the western slope of the mountains to the sea.

33. STEPHENS CAÑON MOUSE. **Peromyscus crinitus stephensi.**
Rare this far south. Found in cañons and valleys on the east slope.

34. LARGE-EARED HARVEST MOUSE. **Reithrodontomys megalotis.**
Occurs in grassy places and weed patches in valleys on the eastern slope of the mountains and along the edge of the desert.

35. LONG-TAILED HARVEST MOUSE. **Reithrodontomys longicaudus.**
Abundant in grass and weeds in the mountains and west to the seacoast.

36. LONG-EARED BRUSH RAT. **Neotoma fuscipes macrotis.**
Common in brush from the summit of the mountains to the seacoast.
Scarcely or not injurious.

37. INTERMEDIATE BRUSH RAT. **Neotoma intermedia.**
Cholla cactus thickets in foothills and west to the sea.

38. YELLOW BRUSH RAT. **Neotoma intermedia gilva.**
Cactus thickets of the foothills bordering the desert.

39. MESQUITE BRUSH RAT. **Neotoma albigula venusta.**
Colorado Desert and bordering foothills. Frequents mesquite brush.

40. SOUTHERN CALIFORNIA MEADOW MOUSE. **Microtus californicus neglectus.**
Abundant in grassy localities in the mountains and west to the seacoast.

Family GEOMYIDÆ. Pocket Gophers.

The food is vegetable, principally roots and tubers. Stems of plants are also cut off and drawn into the runs. Worms and insects found in the runs are also eaten. Pocket Gophers are quite injurious in cultivated land, especially in fruit orchards. They are easily trapped. Poison and bi-sulphide of carbon are often used in the runs and are moderately effective.

41. TAWNY POCKET GOPHER. **Thomomys nigricans.**
Abundant in the mountains.

42. SOUTHERN POCKET GOPHER. **Thomomys bottæ pallescens.**
Abundant in the foothills and west to the seacoast.

43. IMPERIAL VALLEY POCKET GOPHER. **Thomomys perpallidus albatus.**
Colorado Desert and bordering foothills. Not common in many places.

Family HETEROMYIDÆ. Pocket Rats and Pocket Mice.

Differ from common rats and mice in having pockets in the sides of the neck similar to those of pocket gophers. Sometimes destructive, but not often abundant in cultivated land. Nocturnal. The food is principally seeds. Often called Kangaroo Rats.

45. DULZURA POCKET RATS. **Dipodomys streatori simulans.**
Western slope of the mountains. Not common.

46. BIG DESERT POCKET RAT. **Dipodomys deserti.**
Common in parts of the Colorado Desert and in the bordering foothills. Usually found in small colonies.

47. MIMIC POCKET RAT. **Dipodomys merriami simiolus.**
Abundant in the valleys of the eastern slope of the mountains and in the Colorado Desert.

48. BANGS' POCKET MOUSE. **Perognathus panamintus bangsi.**
Valleys of the eastern slope of the mountains. Not common.
49. SAND POCKET MOUSE. **Perognathus panamintus arenicola.**
Western border of the Colorado Desert. Rare.
50. PACIFIC POCKET MOUSE. **Perognathus pacificus.**
A very small species. The four known specimens were taken within a mile of the sea in this county.
51. BAILEY POCKET MOUSE. **Perognathus baileyi.**
Eastern slope of the mountains near the border. Rare.
52. LONG-TAILED POCKET MOUSE. **Perognathus formosus.**
Valleys of the eastern slope of the mountains. Not common.
53. TUFT-TAILED POCKET MOUSE. **Perognathus penicillatus.**
Abundant in places in the Colorado Desert and in the valleys of the eastern slope of the mountains.
54. SHORT-EARED POCKET MOUSE. **Perognathus fallax.**
Rather common in the western foothills and thence to the sea.
55. PALLID SHORT-EARED POCKET MOUSE. **Perognathus fallax pallidus.**
Eastern slope of the mountains. Rather common in rocky ground.
56. DARK POCKET MOUSE. **Perognathus californicus femoralis.**
Foothills and western slope of the mountains. Not common.
57. SPINY POCKET MOUSE. **Perognathus spinatus.**
Foothills and low mountains bordering the Colorado Desert. Usually found in rocky places. Seldom common.

Family LEPORIDÆ. Hares and Rabbits.

A rather large family of some economic importance, partly because of the value of their flesh for food, and partly because of the damage occasionally done to crops and fruit trees. Their food is vegetable, mostly the leaves, stems, branches and bark of plants and shrubs, which are bitten off and eaten on the spot. The young of Rabbits are born blind and hairless in underground nests, while those of Hares are well haired at birth and can see and very soon can take care of themselves.

58. SAN DIEGO JACK RABBIT. **Lepus californicus bennetti.**
Common from the sea to the pine forests.
59. COLORADO DESERT JACK RABBIT. **Lepus californicus deserticola.**
More or less common from the eastern slope of the mountains to the Colorado River. This light-colored subspecies is subject

to severe epidemics, sometimes almost to the extent of extermination.

60. SAN DIEGO COTTONTAIL. **Sylvaticus auduboni sanctidiegi.**

Common from the coast to the pine forests.

61. ARIZONA COTTONTAIL. **Sylvaticus auduboni arizonæ.**

Rather common in places in the foothills bordering the Colorado Desert and east through Arizona.

62. ASHY BRUSH RABBIT. **Sylvaticus bachmani cinerascens.**

Common in thick brush from the coast to the higher mountains. Seldom seen in the open.

Order PINNIPEDIA. Seals.

Family PHOCIDÆ. Earless Seals.

Seals are abundant along Arctic seashores; common along those of temperate regions; less common or wanting along tropical coasts. The food is fish and some crustaceans and mollusks. The fish are caught by pursuit in the water. Seals must come to the surface every few minutes to breathe, and they come ashore occasionally to rest and to bask in the sun.

63. SAN GERONIMO HARBOR SEAL. **Phoca richardi geronimensis.**

Occasional in San Diego Bay and at sea; a small herd stays in Mission Bay. They destroy many fish and in that way are injurious to human interests with but little good to offset the loss.

Family OTARIIDÆ. Eared Seals.

64. CALIFORNIA SEA LION. **Zalophus californianus.**

Occasional along the coast. Prefer the neighborhood of rocky islands, which are lacking near the coast in this county.

Elephant Seals, **Macrorhinus angustirostris,** formerly were abundant on some of the Santa Barbara Islands. I know of no records of any Elephant Seals having been seen on shore within San Diego County but this probably occurred at times when they were still common. The species is very nearly exterminated, a small herd of about a dozen individuals that occasionally comes ashore on Guadaloupe Island being the only known survivors.

Order CARNIVORA. Flesh-eating Mammals.

Family FELIDÆ. Cats.

65. PACIFIC COAST PUMA. "Mountain Lion". **Felis oregonensis.**

Still occasionally found in San Diego County. I have never seen one alive out of a cage. The food is flesh exclusively. Being large and powerful they are able to catch large game, such

as deer, bighorns, colts, calves and hogs. They kill only for food. Instances of their attacking people are rare and nowadays they avoid men as much as possible.

66. CALIFORNIA BOBCAT. Wildcat. **Lynx eremicus californicus.**

Common in brush and forests throughout the county. They vary greatly with age and season, in color, spotting, and size of ear tuft. Bobcats prey on all the smaller mammals and birds and frequently on poultry. Most of their hunting is done in the night but they prowl around more or less in the daytime.

The Canada Lynx does not occur here.

Family CANIDÆ. Wolves, Dogs and Foxes.

This is a rather large family, distributed over all the world. All are carnivorous, but many species eat other food, such as fruits.

67. VALLEY COYOTE. **Canis ochropus.**

Rather common from the summit of the mountains to the seacoast. Sometimes harmful to poultry and occasionally to sheep and young stock. In the long run this harm is nearly offset by their destruction of gophers, squirrels and mice and by keeping rabbits in check around grain fields, vineyards and orchards. Rather fond of grapes and occasionally troublesome in vineyards. We are apt to remember the harm they do and give them scant credit on the beneficial side.

68. DESERT COYOTE. **Canis ochropus estor.**

Common on the eastern slope of the mountains and on the Desert.

A smaller, brighter colored race (**Canis ochropus mearnsi**) probably occurs in the mountains, but not enough examples are available to decide the point.

69. LONG-EARED KIT FOX. **Vulpes macrotis.**

It is reasonably certain that this Fox formerly occurred in the region between the sea and the mountains, and probably a few still live here.

70. MOHAVE DESERT KIT FOX. **Vulpes macrotis arsipus.**

Occasional in the Mohave Desert and Colorado Desert. I have trapped this pale colored race at Borego Springs in the northeastern part of this county.

71. CALIFORNIA GRAY FOX. **Urocyon cinereoargenteus californicus.**

Common in brush and forest in many parts of the county.

Family PROCYONIDÆ. Raccoons, etc.

A rather small family distributed through temperate and tropical America. The food is small mammals, birds, eggs, fish, insects, fruit and seeds. Nocturnal. Terrestrial and arboreal.

72. CALIFORNIA RING-TAILED CAT. **Bassariscus astutus raptor.**

Occasionally found in the northern part of the county. Apparently a recent immigrant from further north, as the Indians did not know the animal. The earliest capture that I know of was in 1907, at the southern foot of Palomar Mountain.

73. SOUTHWESTERN RACCOON. **Procyon psora californicus.**

Common from the mountains to the seacoast.

Family URSIDÆ. Bears.

74. CHIEF GRIZZLY. **Ursus magister.**

The type of this species was killed at the head of San Onofre Canon, in the northwestern part of this county, in 1900. He was estimated to weigh 1400 pounds. This is about the largest species of bear known. The species is nearly or quite extinct. Fifty years ago they were rather common in the mountains of this county.

I know of no authentic record of black bears ever having been found in this county.

Family MUSTELIDÆ. Weasels, etc.

This is a rather large and important family of nearly world-wide distribution. The fur of many species is of high quality. Many species are provided with large scent glands, the scent usually being very disagreeable.

75. CALIFORNIA WEASEL. **Mustela xanthogenys.**

Western slope of the mountains and west to the sea. Not common. Beneficial by destroying gophers, mice and squirrels. This species of Weasel seldom kills poultry and should never be killed except individuals known to have acquired the habit of killing poultry.

76. CALIFORNIA SPOTTED SKUNK. **Spilogale phenax.**

Common in the mountains, occasional on the mesas west to the sea. The food is mice, birds, eggs, poultry, insects and grubs. They are bold, having great confidence in their peculiar means of defense. They are good climbers and their small size permits them to enter squirrel holes. They destroy some poultry, some of this destruction being laid to weasels. It is a well established fact that bites of some species of skunks of this genus cause a form of hydrophobia, but cases of hydrophobia from skunk bites in California are not well authenticated.

77. SOUTHERN CALIFORNIA SKUNK. **Mephitis occidentalis holzneri.**

Common throughout the county.

78. WESTERN BADGER. **Taxidea taxus neglecta.**

Generally distributed. Not very common.

79. SOUTHERN SEA OTTER. **Latax lutris nereis.**

Very rare. Sometimes seen in kelp beds.

Order INSECTIVORA.

Family SORECIDÆ. Shrews.

A large family of quite small animals, most abundant in the colder parts of the northern hemisphere. The food is insects and mice.

80. ADORNED SHREW. **Sorex ornatus.**
In the mountains. Rare.

81. GRAY SHEW. **Notiosorex crawfordi.**
Mountain and mesa. Rare.

Family TALPIDÆ. Moles.

A moderate sized family generally distributed over the north temperate zone. The food is insects, larvæ, etc., obtained in burrowing through the soil.

82. SOUTHERN CALIFORNIA MOLE. **Scapanus latimanus occultus.**
Rather rare near the coast; more common in the mountains. These Moles do not eat the roots of plants or other vegetation.

Order CHIROPTERA. Bats.

Bats are found in all parts of the world except the polar regions. The food of California species is insects caught in the air.

Family VESPERTILIONIDÆ. Bats.

A rather small family, most common in temperate regions.

83. PALE BAT. **Antrozous pallidus.**
This large Bat is found in the Colorado Desert and in the bordering foothills. It is not common.

84. PACIFIC PALE BAT. **Antrozous pallidus pacificus.**
Occasional in the mountains; probably found also in the coast region. but I have no record from there.

85. PALE LUMP-NOSED BAT. **Corynorhinus macrotis pallescens.**
Rather common in the Colorado Desert and occasional in the coast region.

86. LONG-SHANKED BAT. **Myotis lucifugus longicrus.**
Generally distributed but not common in the coast region.

87. OAK FOLIAGE BAT. **Myotis californicus quercinus.**
Common in the mountains and in the coast region.

88. LA GRULLA BROWN BAT. **Myotis orinomus.**
Found in the mountains. Not common.

90. LONG-EARED BAT. **Myotis evotis.**
Found throughout the county. Not common.

91. WESTERN BAT. **Pipistrellus hesperus.**
Abundant in spring and rather common in summer and autumn in the Colorado Desert and bordering foothills.

92. MERRIAM BAT. **Pipistrellus hesperus merriami.**
Occasional in the coast region.
93. SAN BERNARDINO BAT. **Eptesicus fuscus bernardinus.**
Common in the mountains.
94. WESTERN RED BAT. **Nycteris borealis teliotus.**
Winter residents in valleys. Not common.
95. HOARY BAT. **Nycteris cinerea.**
Winter residents in valleys. Rare. Sometimes found hanging in fruit trees.

Family MOLLOSSIDÆ. Free-tailed Bats.

A small family of tropical and sub-tropical distribution.
96. MOHAVE BAT. **Nyctinomus mexicanus mohavensis.**
Common in the Colorado Desert and bordering foothills; less common or occasional in the coast region.
97. CALIFORNIA MASTIFF BAT. **Eumops californicus.**
Rare winter residents in the coast region and in the Colorado Desert. I know of no summer records anywhere.

Family PHYLLASTOMATIDÆ. Leaf-nosed Bats.

A tropical American family. Some species eat fruit as well as insects.
98. CALIFORNIA LEAF-NOSED BAT. **Macrotus californicus.**
Found in foothills and valleys, often in caves.

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By FRANK STEPHENS

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Class Amphibia

Order CAUDATA. Salamanders.

Young salamanders begin life as aquatic animals, breathing by means of gills. Later in life a transformation occurs; the gills disappear and the animal then breathes by means of lungs and are adapted for life on land. The skin is not covered with scales. The limbs are small and comparatively weak. They retain their tails through life.

Family PLETHODONTIDÆ.

1. ARBOREAL SALAMANDER. **Aneides lugubris.**

The only San Diego County occurrences known to me are—Falls of the San Diego River, Sorrento Mountain near La Jolla, and in the Sequoia Mine. Probably more common than these records indicate.

2. SLENDER SALAMANDER. **Batrachoseps attenuatus.**

In wet weather these little lizard-like animals may be found under boards lying on the ground and under stones in the coast region; and in the mountains under rotten logs. In the dry season they burrow in the soil.

Order SALIENTA. Toads and Frogs.

Toads and frogs begin life as aquatic animals (tadpoles), in a manner similar to salamanders, and like them transform from water breathing to air breathing animals; but in the transformation they lose their tails. The limbs, acquired in the transformation, are comparatively long and strong. The food is insects caught on the tip of the protruded tongue. They are principally nocturnal.

Family PELOBATIDÆ.

3. WESTERN SPADEFOOT TOAD. **Scaphiopus hammondi.**

Two San Diego specimens are in the collection of the Natural History Museum; one was taken in May, the other in August.

Family BUFONIDÆ.

4. CALIFORNIA TOAD. **Bufo borealis halophilus.**

Generally distributed throughout the County except in the Desert.

5. SPOTTED TOAD. **Bufo punctatus.**

Found around springs and in damp places along the edge of the Colorado Desert and on the eastern slope of the mountains.

Family HYLIDAE.

6. PACIFIC TREE FROG. **Hyla regilla.**

Common from the sea to the eastern slope of the mountains. Usually found on the ground. Variable and changeable in colors.

7. ARIZONA TREE FROG. **Hyla arenicolor.**

Common about springs and damp places on the summits and eastern slope of the mountains. Unlike the eastern tree frogs the Californian species do not inhabit trees to any great extent.

Family RANIDÆ.

8. CALIFORNIA RED-LEGGED FROG. **Rana aurora draytoni.**

Common on the western slope of the mountains and west to the sea.

The Yellow-legged Frog, Rana boylii, is found in the San Jacinto Mountains, but has not been reported from this County.

Class Reptilia

Order SQUAMATA.

Suborder SAURIA. Lizards.

Lizards are cold-blooded quadripedal vertebrates that breathe air by means of lungs from birth. Limbs are absent in a few degenerate species. Lizards may be terrestrial, subterranean or arboreal; diurnal, crepuscular or nocturnal in habit. Some species are insectivorous or carnivorous; other are vegetarian; the greater number include both animal and vegetable food in their diet. Many species are oviparous; a few are viviparous. Lizards are most abundant in warm climates.

Family EUBLEPHARIDÆ.

9. BANDED GECKO. **Coleonyx variegatus.**

Found occasionally on the eastern slope of the mountains. Spend the day in crevices of rocks or underground. Nocturnal and insectivorous. Harmless. The scales on the upper surface of the body are smaller than in other families of lizards.

In November, 1920, I captured a specimen of the Warty Gecko, Phyllodactylus tuberculosus, on Coyote Mountain, west-

ern Imperial county. This species probably occurs also in the foothills of eastern San Diego county.

Family IGUANIDÆ.

This family of lizards is principally tropical in distribution. Many species are very large, some becoming six feet in length; our representatives are comparatively insignificant animals. The species living in the Desert are able to do without water.

10. DESERT IGUANA. **Dipsosaurus dorsalis.**
Common in parts of the Colorado Desert. Herbivorous.

11. GRIDIRON-TAILED LIZARD. **Callosaurus ventralis.**
Common in the Colorado Desert and in the valleys of the eastern slope of the mountains; the food is ants, beetles, grasshoppers, etc.

12. LEOPARD LIZARD. **Crotaphytus wislizeni.**
Occasional in the Colorado Desert and on the eastern slope of the mountains. The food is leaves, blossoms and insects and other lizards.

13. BAILEY COLLARED LIZARD. **Crotaphytus collaris baileyi.**
Occasional on the eastern slope of the mountains. The food is like that of the preceding species.

14. CHUCKWALLA. **Sauromelas ater.**
Found in rocky localities. Not common in this county, but we have specimens from 2,000 feet altitude on the eastern slope of the Cuyamaca Mountains. Herbivorous. Harmless. Sometimes mistaken for the "Gila Monster", which is not found in California.

15. MEARNS LIZARD. **Uta mearnsi.**
Lives among boulders and on the face of cliffs on the eastern slope of the mountains. Not common.

16. DESERT BROWN-SHOULDERED LIZARD. **Uta stansburiana elegans.**
Generally distributed on the eastern slope of the mountains and in the Desert.

17. SOUTHERN BROWN-SHOULDERED LIZARD. **Uta stansburiana hesperis.**
This subspecies is common in Southern California from the sea to the summit of the mountains. The food is flies, beetles, ants, spiders, etc.

18. LONG-TAILED LIZARD. **Uta graciosa.**
Lives in bushes and trees on the eastern slope of the mountains and in the Desert. Food, insects and leaves.

19. VAN DENBURGH LIZARD. **Sceloporus graciosus vandenburghianus.**
Rather common in forests and among rocks in the Laguna, Cuyamaca and Palomar Mountains.

20. FENCE LIZARD. **Sceloporus occidentalis biseriatus.**
Common throughout the county except the Colorado Desert and in the lower bordering foothills. Food, insects.

21. ROUGH-SCALED LIZARD. **Sceloporus magister.**
Occasional on the eastern slope of the mountains below 3,000 feet altitude. Frequent yuccas, rocks and brush thickets. Food, insects.

22. ORCUTT LIZARD. **Sceloporus orcutti.**
Common from the sea coast eastward part way down the mountains. Found in brush and among rocks.

23. BLAINVILLE HORNED LIZARD. "Horned Toad." **Phyrnosoma blainvillei.**
Common in the coast region, occasional in the mountains. Food, ants, beetles and other insects.

24. DESERT HORNED LIZARD. **Phyrnosoma platyshinus.**
Common in the Colorado Desert and in valleys on the eastern slope of the mountains.

25. FLAT-TAILED LIZARD. **Anota mccalli.**
Colorado Desert and lower part of the valleys in the bordering foothills. Not common.

Family ANGUIDÆ.

26. SAN DIEGO ALLIGATOR LIZARD. **Gerrhonotus scincicaudus webbi.**
Common in the coast region and occasional on the western slope of the mountains. This comparatively slow moving snake-like lizard is harmless, like all lizards living in this county. The food is insects, with occasionally a small lizard of some other species.

Family ANNIELLIDÆ.

Lizards of this family lack legs but rudiments of the pelvic girdle may be found by dissection. The tail is very blunt and the animal looks more like an angleworm than a lizard.

27. SILVERY FOOTLESS LIZARD. **Anniella pulchra.**
Found in a sandy or soft soil throughout the central and western part of the county. Usually burrow in the soil in the daytime. I have found them under boards and stones.

Family XANTUSIDÆ.

A family of quite small lizards having small scales on the upper surface and large ones in conspicuous transverse series on the belly. They are nocturnal.

28. DESERT NIGHT LIZARD. **Xantusia vigilis.**
Rather common in semi-desert localities on the eastern slope of the mountains, mostly under the dead leaves of yuccas and agaves.

29. HENSHAW NIGHT LIZARD. **Xantusia henshawi.**
Appears to be rare. So far only found in three or four localities on the western slope of the mountains. Not reported from any place outside of this county. Found in crevices of rocks. Crepuscular and nocturnal.

Family TEIIDÆ.

30. DESERT WHIP-TAILED LIZARD. **Cnemidophorus tigris.**
Common in the Colorado Desert. Insectivorous.

31. STEJNEGER WHIP-TAILED LIZARD. **Cnemidophorus tigris stejnegeri.**
Locally common in the mountains and west to the sea.

32. BELDING ORANGE-THROATED LIZARD. **Cnemidophorus hyperythrus beldingi.**
Coast region not common.

Family SCINCIDÆ.

33. WESTERN SKINK. **Plestiodon skiltonianum.**
Usually found lying under boards or stones or among dead leaves. Young individuals have bright blue tails. Principally nocturnal. Insectivorous.

Suborder SERPENTES. Snakes.

Snakes are born with lungs. Limbs are absent. The body is covered with scales. Snakes follow many modes of life; terrestial, arboreal, subterranean, aquatic; diurnal, nocturnal or crepuscular. Progression may be straightforward, by movement of the broad scales of the under surface; by pushing with the back side of the curves of the body and tail; or by a combination of both methods. In cold climates snakes hibernate in winter; in hot climates æstivation may take place in the hotter or drier seasons. They are carnivorous. Snakes are usually oviparous, but a few species are viviparous.

Family LEPTOTYPHLOPIDÆ.

34. WORM SNAKE. **Leptotyphlops humilis.**
Very rare. Two have been found on the eastern slope of the mountains.

Family BOIDÆ.

35. CALIFORNIA BOA. Rubber Snake. **Lichanura roseofusca.**
Not common. Foothills.

36. CALIFORNIA GARTER SNAKE. **Thamnophis ordinoides hammondi.**
Common in most parts of the county, near or in water. Food insects, tadpoles, small fish.

37. DESERT BURROWING SNAKE. **Sonora occipitalis.**
Colorado Desert and valleys on the eastern slope of the mountains. Burrows in sandy or soft soil.

38. LITTLE RING-NECKED SNAKE. **Diadophis amabilis.**
Western slope of the mountains and west to the sea. Rather common. Food earthworms, salamanders and probably insects

39. CORAL KING SNAKE. **Lampropeltis pyromelana multicincta.**
Occasional in the mountains.

40. BOYLE KING SNAKE. **Lampropeltis getulus boylii.**
Rather common throughout the county.

41. CALIFORNIA KING SNAKE. **Lampropeltis californiæ.**
Occasional in the mountains.

42. LONG-NOSED SNAKE. **Rhinocheilus lecontei.**
Rather common throughout the county.

43. SPOTTED NIGHT SNAKE. **Hypsiglena ochrorhyncha.**
Apparently rare. Several have been taken in various parts of the county. Nocturnal.

44. PATCH-NOSED SNAKE. **Salvadora hexalepis.**
Not common. Mountains and mesa.

45. WESTERN YELLOW-BELLIED RACER. **Coluber constrictor vetustus.**
Has been found in various places in the county, but does not seem to be common.

46. RED RACER. **Coluber flagellum frenatus.**
Valleys and foothills. Not very common.

47. CALIFORNIA STRIPED RACER. **Coluber lateralis.**
Rather common, but not often seen. Inhabits chapparal.

48. FADED SNAKE. **Arizona elegans.**
Apparently rare. Has been found in the mountains and along the coast.

49. WESTERN GOPHER SNAKE. Bull Snake. **Pituophis catenifer.**
One of the largest snakes found here. Found almost everywhere in the county. A very beneficial snake; anyone killing a Gopher Snake should be fined. They are not poisonous or harmful to mankind. They feed on gophers, mice, rats and squirrels.

50. DESERT GOPHER SNAKE. **Pituophis catenifer deserticola.**
This subspecies of the Gopher Snake inhabits the eastern slope of the mountains and the region eastward.

None of the snakes listed above are poisonous, or to be feared in any way. Most of them are beneficial and none should be killed. Snakes of all kinds are much less numerous than when this region was first settled. The following species are poisonous, but they are not aggressive and ordinarily will not attack if they are not disturbed.

subfamily BOIGINÆ.

51. CALIFORNIA TANTILLA. **Tantilla eiseni.**

These little snakes are rare. I found one at Witch Creek. They have grooved fangs and a small poison gland. The poison is used for subduing their prey.

Family CROTALIDÆ. Rattlesnakes.

52. PACIFIC RATTLESNAKE. **Crotalus oreganus.**

Found throughout the county except in the Desert. Most common on the mesas.

53. RED RATTLESNAKE. **Crotalus exsul.**

Found throughout the mountains and occasionally on the mesas.

54. PALLID RATTLESNAKE **Crotalus mitchelli.**

Found on the eastern slope of the mountains and in the Colorado Desert.

55. SIDEWINDER. HORNED RATTLESNAKE. **Crotalus cerastes.**

Common locally in the Colorado Desert and in the valleys on the eastern slope of the mountains. Has a peculiar sidewise method of locomotion.

Rattlesnakes molt the old skin two or three times each year. A new rattle is added at each molt; the terminal rattles wear loose and drop off; if the snake lives on rocky ground the rattles wear off faster than when the snake lives on softer ground. The number of rattles remaining are no guide to the age of the snake.

Order TESTUDINATA.

Family DERMOCHELIDÆ. Sea Turtles.

Outer surface covered with a thick leather-like skin, limbs flat, paddle-like, adapted for swimming. Inhabits tropical seas, but occasionally straggles to temperate waters.

56. PACIFIC LEATHERBACK TURTLE. **Dermochelys schlegeli.**

One caught off Point Loma about 1888 was exhibited in the Coronado Museum. Said to have weighed 800 pounds.

Family CHELONIDÆ. Sea Turtles.

Outer surface covered with horny plates. Limbs paddle-like. Inhabit tropical seas, straggling to temperate waters.

57. PACIFIC GREEN TURTLE. **Chelonia japonica.**

Straggle to the California coast occasionally. Several have been seen in San Diego Bay and in Mission Bay. One was caught at National City several years ago. The food is said to be sea weeds.

Family TESTUDINIDÆ. Mud Turtles and Tortoises.

Outer surface covered with horny plates. Feet adapted for walking on land. Size comparatively small.

58. PACIFIC MUD TURTLE. **Clemmys marmorata.**

Occasional locally, in the coast region. There are few suitable streams or ponds in this county where Mud Turtles could live.

The Desert Tortoises have been found in Imperial County and it is possible that they may occur in the northeastern corner of San Diego County.

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